

**STATE OF CALIFORNIA  
ENERGY RESOURCES CONSERVATION  
AND DEVELOPMENT COMMISSION**

In the Matter of:	)	
	)	Docket No. 96-RD&D-1890
Implementation of Restructuring	)	
Legislation (Chapter 854,	)	
Statutes of 1996, AB 1890): RD&D	)	
_____	)	

**COMMITTEE HEARING  
RE: IMPLEMENTING THE RD&D PROVISIONS  
OF AB 1890**

**Monday  
December 2, 1996  
10:00 A.M.**

**1516 Ninth Street  
Sacramento, California  
Hearing Room A**

**REPORTED BY:**

**A. FLYNN**

**COMMISSIONERS PRESENT**

CHARLES R. IMBRECHT, Chairman

SALLY RAKOW, Vice Chair and Presiding Member

DAVID A. ROHY

JANANNE SHARPLESS

**STAFF PRESENT**  
(Alphabetically Listed)

David Abelson

Mike Batham

Mike DeAngelis

**ALSO PRESENT**  
(Alphabetically Listed)

Donald W. Aitken, Union of Concerned Scientists

James R. Augustyn, Augustyn + Company

Mark Axford, Stewart & Stevenson

John R. Benemann, Consultant

Larry L. Berg, Larry Berg & Associates

David A. Berokoff, Southern California Gas Company

Carl Blumstein, UC Energy Institute

Richard Brent, Solar Turbines

Barry L. Butler, Science Applications International Corporation

**ALSO PRESENT**  
(Continued)

Vashek Cervinka, State of California, Dept. of Food and Agriculture

Jim Cole, California Institute for Energy Efficiency

Henry A. Courtright, Electric Power Research Institute

Keith G. Davidson, Onsite Energy

David Duchane, Hot Dry Rock Energy

Mark E. Hanson, Energy Center of Wisconsin

George A. Hay, III, Collaborative Advanced Gas Turbine

Alan Jacobson, TSS Consultants, Inc.

Janet Joseph, New York State Energy Research and Development Authority

E.E. (Ed) Keffer, Stewart & Stevenson

Robert M. Kendall, Alzeta Corporation

Betsy L. Krieg, Pacific Gas and Electric Company

H.M. "Hank" Leibowitz, Exergy, Inc.

Bill Marshall, National Renewable Energy Laboratory

Laura A. Martin, California Public Utilities Commission

Mark P. Modera, Lawrence Berkeley National Laboratory

Thomas P. Morjig, Genxon Power Systems

Orville Moe, Energy 2000, Inc.

Bob Mucica, Rockwell International

Michael J. Murray, Pacific Enterprises Company

Eric R. Newman, KAHL Associates

**ALSO PRESENT**  
(Continued)

Thomas D. O'Connor, Southern California Edison

Vishwesh M. Palekar, NoxTech

Larry Papay, Bechtel Technology and Consulting, Inc.

Betty Riley, Sierra Planning Organization, Sierra Economic Development District

James Sahagian, Photovoltaics International, LLC

James Sharman, InteTech, Inc.

Daniel S. Shugar, PowerLight Corporation

J. Charles Solt, Catalytica

Necy Sumait, Arkenol

Michael Theroux, Theroux Environmental Consulting Services

Jane Hughes Turnbull, Peninsula Energy Partners

Philip M. Vermeulen

Dan Whitney, Sacramento Municipal Utility District

Ramin Yazdani, Yolo County Dept. of Public Works and Transportation

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## **PROCEEDINGS**

**PRESIDING VICE CHAIR RAKOW:** Welcome. I am pleased to see this large turnout for the start of what I believe will be a pivotal point for California's public interest energy research, development and demonstration activities.

When Governor Wilson signed Assembly Bill 1890 into law on September 23rd of this year, he initiated the most radical change to occur in California's energy business in the last 50 years. The passage of AB 1890 ushers California's electricity marketplace into a competitively based environment. The ramifications have been felt on Wall Street and we will certainly cause some of our own in the national RD&D debate.

By its very nature, competition focuses on near-term results. RD&D programs in a competitive energy market tend to produce only those items that generate rapid economic returns. However, the development of new energy technologies involve issues that are not competitively driven. Without the foresight of AB 1890, the development of these technologies would have been jeopardized in the near term.

The law establishes at least \$62.5 million per year between 1998 and 2001 for funding public interest RD&D programs to advance science or technology that are not adequately provided for by competitive and regulated markets.

Second, the law makes the Energy Commission responsible for funding public interest energy RD&D programs, other than for transmission and distribution

functions, pursuant to administration and expenditure criteria to the established by the Legislature.

As you know, the implementation of the provisions of AB 1890 involve both the Energy Commission and the CPUC. Representing the CPUC today is Laura Martin Daly who is sitting in the audience. I would like to indicate that the Energy Commission is coordinating with the CPUC on all issues of the public interest programs identified in the bill. One such area of coordination is the CPUC's decision of how much of the \$62.5 million identified in the law will be allocated for public interest RD&D versus that to be allocated for public interest transmission and distribution RD&D to be used by the utilities.

We have asked the CPUC to make their decision as early as possible so we can effectively plan our program that we are discussing today. Our information is that the CPUC intends to make the funding split decision early in 1997. I would like to stress in that regard, that today's hearing does not in any way affect the CPUC's process.

The purpose of the hearing today is to begin the process of how best to structure a public interest RD&D program that can achieve efficient and effective results. No small task indeed. Fortunately, serious ground-breaking has already occurred, making our task somewhat easier.

The RD&D Working Group, formed in response to the CPUC March 1996 Roadmap Decision, became the workhorse, producing a seminal document in this debate. The Energy Commission applauds the effort of each of you who were involved in developing this report. I believe that it has provided us sound



guidance on which to build.

The Working Group concluded that the agency responsible for administering public interest RD&D funds has three primary goals: serving the public interest, supporting state energy policy, and addressing the needs of consumers.

In addition, the Working Group developed a set of four performance criteria for the public interest RD&D:

One, an open and flexible planning process.

Two, effective and efficient program implementation.

Three, maintain public accountability.

Four, collaborate and enhance California's RD&D infrastructure.

These goals and performance criteria provide the platform from which to implement the directives of AB 1890.

In answering "how to develop a public interest RD&D program of California," we believe important to review what others have done. We are interested in identifying existing models of public interest RD&D programs, the manner in which these programs are planned, the needs of the RD&D community with respect to public interest RD&D programs, the vital elements of a successful public interest RD&D program, and perhaps most importantly, the lessons learned from both those who administer and those who use public interest RD&D programs.

Today's hearing will be divided into three major parts. It will begin with presentations and discussion by a panel of expert witnesses who have had

extensive experience with the opportunities and challenges of planning and administering energy RD&D programs.

Following the presentations by panel one, we will then hear presentations and discussion in the early afternoon by a panel of representatives responsible for conducting energy RD&D activities and which have worked with RD&D institutions such as those represented on the first panel.

The third and last part of the hearing will seek input and discussion from all other participating stakeholders and members of the public on the plan, administrative and expenditure criteria, and their lessons learned.

Once again, I welcome each of you to this hearing, and look forward to hearing what I expect to be an interesting and informative set of presentations and exchanges on this important topic.

At this time, I want to introduce Charles Imbrecht, Chairman of the California Energy Commission; Commissioner Jan Sharpless, and Commissioner David Rohy.

Are there any remarks you would like to make?

[Comments made by Chairman Imbrecht.]

**COMMISSIONER ROHY:** I look forward to your comments today.

**PRESIDING VICE CHAIR RAKOW:** At time point I'd like to introduce also Ms. Catherine Small who's the Project Administrator. And anyone who has any written statements may give them to Cathy. She's here someplace. There she is. So we can ensure that all material is properly documented.

And now I'd like to introduce Mr. Carl Weinberg, the former director of PG&E's RD&D program and who is now in private consulting. Carl will be the moderator of the first two panels today. His role will be to ensure that the panelist's remarks are kept focused on the specific topics areas and to stimulate discussion among the panelists at the end of the presentations.

Carl.

**MR. WEINBERG:** Thank you, Vice Chair Rakow, Chairman Imbrecht, Commissioners Sharpless and Rohy. It's a pleasure for me to be here and most of you know my heart and soul have been in R&D for a long time. And with the kind of changes going on this last century, R&D is ever more important and in times of change there is a need for continued innovation in R&D in that instigator of innovation. So this is special.

And also, I want to tell you that for every intellectual change that aids the physical change there is an idea that precedes a thought so that R&D is an incubator not only for products but also for ideas and this is particularly proven in terms of the public interested in that situation.

Lyndon Johnson is supposed to have said, "It's hard enough to do what's right, it's really hard to know what is right."

And I want to tell you that the difference between the two panels this morning is panel one's job is to tell us what is right and doing the right thing. How do you plan? How do you get controls? How do you manage to put together a public interest program that is doing the right thing? It's hard enough to know in an industry, the business, what the right thing is in a public interest situation --.

And I would say that this panel, panel two's focus is on doing thing right. That is, how you either act now or how do you do them correctly? And far be it for me to -- having not spoken that for some time, and having lived through the practical problems of PG&E itself -- particularly public interests programs.

So what we're doing this morning, this panel, then is focusing on doing the right thing. What are the goals. The goals of the organization for each of the panelists, how you're going to determine the best things learned in planning a program with public interest involved in it.

And we have a distinguished group. What I'm hoping to do is I will read the names of the panelists and I'll introduce each one of them before, but I'll allow public questions for clarification. Then hopefully we'll get through all the panelists and then have a lively discussion.

Those of you that know me know that I'm not one not to ask controversial types of questions.

The panelists consist of Betsy Krieg who represents PG&E; Jim Cole from CIEE; Hank Courtright who is with EPRI, Janet Joseph from NYSERDA; Bill Marshall from ENRON, and Mark Hanson from the Energy Center of Wisconsin.

We are going to start off with Betsy. Betsy Krieg is the Director of Planning for Research at PG&E. She's currently the chair of the California Utility Research Council. And the California Utility Research Council was established by the Legislature and helps to promote consistency in R&D programs with state energy policy and helps coordinate the activities of the utilities.

So Betsy, this is your opportunity.

And I also have sign here. I'm hoping that you'll keep your remarks to approximately ten minutes. I will not get nasty if you go over. If we get to that point I'll give you a warning. Ten minutes.

**MS. KRIEG:** This is going to be a little difficult. I'm not sure.

Good morning. My name is Betsy Krieg, the Chair of the California Utility Research Council. They are what I'm going to talk about generally on the table.

But given the shortness of time, there's a lot of things in here that I'm not really going to talk about, but there is EPRI --.

So let me tell you a little bit about CURC. And as Carl mentioned, it was established by a legislative mandate in 1982. Basic members are the California utilities: PG&E, San Diego, Southern California Edison, and SoCal Gas. We also have associate members: SMUD and LADWP. And we also invite other municipal utilities who come to our meetings.

Basically, CURC has goals to promote consistency of RD&D programs with state energy policy, prevent unnecessary duplication, freely exchange information, and identify opportunities for joint research.

In the past we have done quite a few cooperative projects with a move for a deregulation of competition. CURC itself does not have a research agenda. It doesn't do specific research the individual utilities do and the idea is to make sure that utilities aren't individually doing research that we could do collectively. And I think that has worked quite well over the years.

The major focus of these discussions are an annual meeting, a mid-

year meeting, and some informal discussions. So that's the CURC format.

What I thought I'd do was talk a little bit about planning an RD&D program. PG&E process is not synonymous with the other utilities, but I think it's fairly standard for a utility program.

One thing to keep in mind in the interest of a utility, and some of these comments probably don't apply to a public interest program, but for a utility, in general. The focus on managing technology change for PG&E, we don't invent technologies very often. And I don't think we've ever actually invented one or developed one.

So the focus for us has been trying to understand new ideas, new technologies from places like National Labs, the Department of Energy, manufacturers, a lot of interaction with vendors. And then trying to figure out which of those apply within the PG&E system and how to integrate those technologies in our system. So we use people like EPRI and GRI and other utilities to help up identify interesting technologies which we then apply to our own system.

And the focus for our department in on understanding technologies, developing them, assessing their conformance before we develop them, and then demonstrate them if they're pretty close to commercialization. There are lots of commercially available technologies that haven't necessarily been used in the utility industry or in the -- a system the size of PG&E. So we do demonstrate technologies.

Just to give you a sense of what our goals are as a department, which I think is something the CEC if they take on the public interest role have to define is: What is the mission? Just to be sure that we're clear.

At PG&E it's to identify, evaluate and deliver technologies to our business units. So all research is driven by what our business units need. We have a lot of business units: a gas business unit, electric transmission business unit.

We do have a nuclear power business unit, but R&D doesn't use ratepayer dollars to fund that research. If we do any research work, which we haven't, they would have to pay for it directly. But basically we try to include: do some scanning, we do assessment, we do development, and we demonstrations based on what the business units need.

Groups like for our electric transmission group needs to know whether there are faults in the transmission lines, so there are some commercially available fault testers. We need to test it on our system to make sure it works with our communications available. Those sorts of things we would do.

For public interest program you'll need to focus on what's most important for whatever amount of money you have.

I think this might be one of the more interesting diagrams which in some ways it's as complicated as it looks, and in some ways it isn't. Basically we start our planning, we're trying to figure out what the corporation is doing, what our business units are doing, what's going on in the outside world. And hopefully that gives us some ideas about some of the R&D that needs to be done.

And at the same time we try to develop plans for what we call research areas. Things like our customer assistance group or our electric transmission group. We try to figure out within those groups what we can do with the money we have available over, say, a three to five year period. And we use that to help us develop

project ideas and also to evaluate the project ideas that are brought to us to see how they fit within an overall structure.

The key to make this process work is to have a lot of interaction between the various players, and to be sure as you're going through the development of your project idea, that you've already thought through what your end point is going to be, and to evaluate both the design of the project, and as you're going through the actual implementation, checking to be sure that the project is still moving in a direction that makes sense given changes in technologies, changes in the outside world, and changes in internal direction.

For example, historically, PG&E has done a lot of work on renewables and electric generation. When we decided we were getting out of that business, we obviously needed to modify our R&D program, close down generation-related projects, and move into areas that were going to be new sources of competitiveness for the company.

So the project list is dynamic over time, although in a given year we hope it's fairly stable.

I've shown this in three ways. One, you have a multi-year plan. You look at your project portfolio to see how well it's balanced because whatever goals you set up, process, things like making sure we're doing some gas related research as well as electric related research, that the electric transmission guys are getting some work done, but also we're not neglecting the electric distribution work.

And then we look at our annual -- how much money we have, our annual budget, and then try to see what projects we have that we can do with that



money and try to figure out how to maximize the benefit so the money becomes available.

I think one of the key things to realize is there really is never enough money. No matter how well focused your program is, people are always going to have wonderful ideas that cost more than you have. You have to be really clear on what you're trying to achieve and make those hard decisions about canceling good projects or not starting them because you really want to get the maximum benefit out of your limited dollars.

Even if the CEC were to get all \$62 million for public interest, it still wouldn't be enough to do all the research that could be out there.

This is just a quick thing to show you how we tied what we do to the corporation. PG&E, for a couple of years, has had a blueprint for success. We had a goal product price to get our electric prices down. For customer service we have some specific goals in being safe and reliable. And then for financial performance. We have some corporate goals that the R&D department has to work toward what we do to be sure that we're helping the corporation go in that direction.

For a public interest program, what I would assume that you would -- your blueprint for success would be the State Energy Policy and then figuring out what part of that State Energy Policy you want to support.

For example, PG&E's R&D department does not directly support the company's financial performance. As I said, we're a user of technology as a corporation. We don't invent things, so we don't get much in royalties that flow from the R&D department back to the ratepayers or to the shareholders. We

probably have \$300,000 a year in royalties which is not much since our entire budget is like 30 million. So we don't really support that, but we do support these other two.

So you need to look at what your goals are as an entity, and then figure out where your R&D program should best support those.

Just a quick overview about technology acquisition, because this has been one of the discussion items within our company for a while, was: What role does the R&D department play?

And for a public interest program you might want to think about the same things. You're thinking about R&D in terms of technology and what you want.

Basically, this is just -- this says the company technology position, are you a leader or a follower? And then the technology availabilities, is it very high or very low? And basically, in this quadrant if you're just sort of a follower in technology you want to buy meters. You are just looking for a plain ordinary meter. Then there's a lot of technology out there and there's really not much of a role for R&D. Our operating department can go buy meters.

On the other hand, if you want to have a lead position for competitiveness or some other reason, then you might want to do a little R&D with others if the technology is available.

On the other hand, if it's not available, you're someplace on this spectrum. And for example, PG&E is doing an automated meter reading demo. And we're sort of in here. We are doing a little bit of R&D, but we're not over here

because the technology is not really available and we don't see it as a way for us to make money as a corporation, so we're not over here. You have to think a little bit about what you're going to do with a technology once you have it before you decide where you're going to put your money.

I think we're on the two last slides. I'm not going to go over this in great detail, but again, we found this very helpful in helping us organize our program and thinking about delivering technology within an institution.

You need to identify the needs, assess the feasibility, develop the technology, test it and then integrate it. And places we've had the most trouble is integrating it in operation. That's partly the way we're corporately organized. But there is an issue about how you hand things off over some wall. So this is something you need to think about as you're planning your program.

You don't have to do all of these by one group, you don't have to go through all the steps. And your technology may be a way along the development lines, so all you need to do is test it, and that's fine. But you need to think through from beginning to end how you are going to get whatever you're working on into the marketplace or into your system operation or it may not go any place.

And the last thing I just wanted to summarize some of the lessons that we've learned and seem to be most applicable to a public interest program. There are some on the other slide, but these are some of the key ones.

We found that the value of R&D use to be set by the user. An R&D department by design has a lot of technologists. And we tend to think if it works and it's great and it's going to pay the company money, that fact that it's very

difficult to install is a minor detail and somebody else should worry about it. That's not the best way to assess the value of the technology. So you need to know who is going to use it and make sure that whatever you've done at the end point you've taken those needs into consideration if you want the technology actually used.

Scanning, generally is the least expensive form of R&D. You're paying salaries and things, but you don't necessarily have to buy a lot of widgets or have a lot of expensive labs.

On the other hand, it can be the most useful, you can learn a lot, you find out who is doing other things. You can avoid doing unnecessary research.

So we found it very valuable.

**CHAIRMAN IMBRECHT:** So you're referencing basically literature searches and that type of think there?

**MS. KRIEG:** And talking to other utilities, talking to the National Labs, talking to anyone who is in the research field to find out what technologies are available to do things like fault testing. Then you may discover you need to do something. But in general, providing information about existing technologies turns out to be very useful.

The keys to R&Ds success I said are clear objectives, strong project management and good budgeting. We've found that we've had failed projects because we weren't quite sure going in what we were trying to achieve. We thought we knew, but in retrospect it was a very muddled objective. So you need to think through that.

Projects have failed because you don't have strong project

management. On the other hand, if you have good project managers they can take a no defined project and re-define it during the course of the work and make it a highly successful project.

So that's been a key for us is having really strong project managers who can understand the technology, manage the schedule and budgeting, and really worry about every step along the way.

There's budgeting -- well, our projects rarely come in exactly where we think they would, but we do have lots of reviews as we go through to be sure that they don't go way over budget without anybody knowing about it. Of if they are way under budget we can reallocate that money.

The key point is there is never enough money. No matter how much money you have, you can always think of better ways and new ways to spending the money. So you have to be very disciplined.

It's suggested if you focus the program in a few key areas you'll be much more successful. The R&D working group has suggested that the public interest program should focus on energy efficiency, renewables generation and environmental issues as those are the areas we see the utilities spending less money on in the future. So those are some other limited lists for projects we think would be -- make you more likely to be successful.

And the main thing is R&D is unpredictable, so build in flexibility. One of our standard quips is if we knew what we were going to get at the end, it wouldn't be R&D. And that's really true. You just don't know.

So go in with your program plan knowing things are going to change.

New technologies will develop. People will leave; people will come. Just build in flexibility in your processes and don't think that just because you think it's a great idea now you'll think the same thing in a year or two.

Questions?

**CHAIRMAN IMBRECHT:** A couple quick ones. You actually answered my question to some extent near the end there. You said the working group was suggesting a focus on energy efficiency, renewables and environmental.

**MS. KRIEG:** Yes.

**CHAIRMAN IMBRECHT:** And within environmental, do you include health and safety issues outside of the responsibility of the -- both distribution?

**MS. KRIEG:** The major focus on the environmental area were things like air and water quality modeling, and things like EMF research that traditionally they're funded by the utilities, but not really going --

**CHAIRMAN IMBRECHT:** I was frankly, that was a reference, health and safety. And I take it you focus on that largely PG&E's emphasis is to have some generation business?

**MS. KRIEG:** Our focus is on what is --?

**CHAIRMAN IMBRECHT:** PG&E is basically declared that they are exiting the generation business.

**MS. KRIEG:** Right.

**CHAIRMAN IMBRECHT:** So that is what's --

**MS. KRIEG:** The majority of our R&D funds can be related research,

and we do quite a bit of -- do homeowner evals and energy efficiency. Some of that we see going away in the new world as the market transformation efforts go forward, some of our R&D department were to support our internal department. We expect that to away.

And we're not quite sure what to do with air and water quality modeling. It's been beneficial for the state as a whole to have high quality air quality models. If we don't have a generation plant we don't have to worry so much about whether the state adopted models accurately show up where the pollution is going, but it's something that needs to be funded and we would like to see that continue.

**CHAIRMAN IMBRECHT:** What about advanced combustion technology that promises to reduce emissions beyond regulatory standards in place, thereby, for example, create another economic golden opportunity also in the --

**MS. KRIEG:** That is sort of research PG&E has funded in the past. We are not at the moment. And I think in general the direction we've gotten from the Public Utilities Commission for all the utilities is it might be good research, but don't spend money on it. Don't spend ratepayer money on it.

**CHAIRMAN IMBRECHT:** I'd like to preface that question.

Finally, in terms of high voltage transmission, do you see that as being a responsibility ultimately to be funded through the ISO and, for example, presumably that's beyond the reach of responsibilities of companies like PG&E in the restructured environment.

**MS. KRIEG:** That's one of the open questions, is where does the role of

the ISO stop and do utilities continue to own the transmission lines. What does that mean? The ISO is going to operate and so there has been some --

**CHAIRMAN IMBRECHT:** Presumably you could argue that to the extent that you increase the load on existing transmission lines, there is a public good associated with that.

**MS. KRIEG:** But one of the things the R&D working group struggled with was whether work for the ISO should be funded out of the initial surcharge discussion, and we just didn't think that this new entity would necessarily have the right expertise to do that. With the CEC, I don't know, but your expertise is in transmission so may have -- that is a good point.

**PRESIDING VICE CHAIR RAKOW:** I'm going to ask Mr. Barry Butler has been requested to call his office. There is a message for you.

**MR. WEINBERG:** Commissioners, do you have any other questions? If not, I have just one.

And that's one of the things you said was the difficulty of --. I'm thinking now that some of the language in AB 1890 sort of went through scanning, but now you've got emerging, new and existing. I would guess that at least for renewables there's some kind of pathway through here.

The question is how to integrate an output that renewables are part of the public interest program, is how to move that way into the outer aspects. Is that your concern here, or --?

**MS. KRIEG:** I think we would draw the line in terms of renewable generation for doing some scanning and things like that since there's another pot of



money to actually get those emerging and new generation, for instance, on line. And I think that interface is the key issue on how do you -- where does the public interest R&D money stop and where does the renewable generation dollars pick up?

But we did think in the RD&D working group, and the CRC members generally felt that that was a hole there. Nobody was going to be doing research on renewable generation and, you know, AB 1890 money seems appropriate.

**MR. WEINBERG:** Thank you.

In the interest of moving, I think we'll move on to the next person which is Henry Courtright from EPRI. And Mr. Courtright is the Vice President of Marketing and External Relations for the Electric Power Research Institute.

Most of you know that EPRI was founded in 1973, funded through the support of over 700 utilities. As everybody else is restructuring, they're restructured and re-thinking to carry out -- their work is carried out by hundreds of individual organizations, they use other firms to do most of the R&D and the benefits of it accrue in the form of products and services and information for direct application by the electric utilities.

**MR. COURTRIGHT:** Thank you, Carl. Good morning, Commissioners.

What I'd like to focus on is really a couple of areas on the few topics you asked us to talk about in terms of our goals, our processes and the lessons that we've learned in the 23 years of doing business.

I want to stress too that we're on a learning curve also. We went through a -- even though we've been doing this for 20 years, we went through a

major re-engineering process back in 1994 to look at how we deliver R&D. And we really really looked at some of our objectives.

There's two basic objectives we work from that are on the overhead. One is to develop the innovative solution, and the second really to address a question that Betsy had about getting R&D over the wall. And in the marketplace, is how to deliver that science and technology into the marketplace to provide affordable, efficient, environmentally sound electricity.

I think that's important. Some of the comments I'll stress on is that role of the delivery side of things in the R&D area.

In addition to our re-engineering we did back in '94, we've gone to a method to improve our processes. We do annual surveys of all of our funders and members to be able to get consistent feedback. Are we getting the relevant R&D that they're looking for? And we also do periodic reviews to look at our effectiveness.

Let me move on to the goals. The key goals -- Would you switch the overhead? Thank you. Already did it.

One thing that we do do is to establish annual goals on both an annual and long term basis. I believe the Commissioners have a copy of the notice up there that will help. We look to try and do our long term at least three years out, but also maintain a long horizon in doing this.

And that planning process for both annual goals and the three-year goals involves not only EPRI's staff, but also our members and outside advisory groups from other organizations, not the utility industry.

We classified our goals in two key areas. One, we put what we call "key

products” are really what we call our major end result of the research and development work that we’ve been doing. And that can include actual hardware, software products or technical reports that end up in the marketplace.

The other goal that we put down are deliverables. And one thing we do do is try to be flexible. We found out in our re-engineering process that you need to set clear objectives for the R&D projects when you are starting these projects. That objective may change over time as you learn things and refine that deliverable, any maybe even changes as the process goes on. But it’s important to set that deliverable and that key result upfront.

We’ve ranked performance of our engineers and scientists against making those deliverable goals and those key result goals.

We also do, as I mentioned, an annual performance measurement against our goals by our members and outside organizations to look and see how are we doing against meeting the deliverables and key products that we stated are the objectives of the research.

I’d like to focus a little bit on the R&D process and some of the critical elements. This slide is in the handout, but it points out some of the key points that I think that are important in R&D.

The first gets into what I would call, we call “strategic synthesis.” It really is in the lefthand side taking a future watch, looking over the horizon, and trying to see what type of new things will be needed in the marketplace both by our members and by society.

We couple that with what’s shown up there as exploratory research on

the lefthand side, which is what we would do is early science. Analyses or concepts, new methods, new mathematical models, things like that. Again, looking out over the horizon and trying to use these and what we would call pushing the envelope. This is where we try and set in our strategic synthesis where are the new directions that the marketplace/society should be going to solve this problem.

We then try and match that with market input, which are both the needs of society and the needs of our voluntary members in this area. And I want to stress that there's a balance need here, because your members input, and sometimes even the market needs tend to be a little bit more near term.

Where we see the over horizon, the synthesis, is more over the long term. And we think that's an important balance that needs to be made that you can actually push the envelop somewhat. If you're just listening to the market input, sometimes you might be on too narrow a spectrum, and not solving some of the longer term problems. We like to look at the long term point as actually creating needs for leading technologies before it's actually observed as being needed in the marketplace.

We do try to use that market input, though, quite heavily. For example, we've done some work with the lighting manufacturers, we've brought in people not only from GE and others, but also leading scientists on lighting behavior techniques, things like that. And we get early input from both a market need, but also a technology need too.

When you move into the project development phase there's a project concept all the way through where you're building the product development and

the product deliverable. There's a couple key points there.

I think one reinforcing some of what Betsy made is that we used experienced scientists and engineers in driving their projects. And I think that's one of the keys to our success over the past 20 years is our project managers aren't just managers, but also add considerably to the value of that project from their technical knowledge and the market networks that they have and the technology networks that they have. We find that extremely important for success.

The other point I'd bring up is the developing of alliances. Because that's bringing critical knowledge from outside just the utility industry. It could be manufacturers; it could be other scientists, other research labs. We often have other research organizations and the federal government participating in the research that we're doing.

They not only bring knowledge, but they also bring leverage as far as funding. We get a significant amount of money from outside sources that help leverage the dollars that might be collected from any type of fee here in California.

And with also use those alliance partners sometimes actually doing some of the research. I think that's important because if you look downstream to commercialization it's important to have some people doing the research who may be able to take it to the commercial stage. If you have too week of a commercialization strategy upfront, you may do a lot of work but you can't get it into the marketplace.

Another key component is the advisory reviews. We think this is a critical component. It includes not only the project participants and funders, but

also the alliance partners and independent review people. We constantly think this interim frequent review cycle is very important to managing the projects effectively and keeping them on target, as well as changing projects that may be off project target.

One of the areas I stressed is very important for California to consider is the righthand side of this slide, the technology transfer commercialization. Because if you do research and leave it on the shelf, it really becomes of little value to the marketplace, to society. And we have found through our re-engineering that we've had to do a lot stronger role in delivering.

We've created over two dozen technology centers across the country, several of which are here in California to help deliver our research results to the marketplace, training utility people in how to apply it, and also working with manufacturers in how to get these things commercialized.

That's the other key point I think is important, that California take a look at how the CEC can commercialize the research that comes out of the work that you do. Because unless you have a successful commercialization strategy or some way to transfer that knowledge into the marketplace, in a sense, the research monies can be wasted.

I'd like to put up here which I think are a half a dozen critical success factors and lessons learned that we have learned over the past 20 years. But especially over the past few years in our process review.

One is objectivity. Even though we're funded by the electric utility industry, we do a strong effort on bringing in outside perspective in terms of

advisory councils from the outside, outside scientists, engineers. This is especially true in our work we did on EMF because we commissioned the blue ribbon panel of non-utility people to manage our EMF work and helped, as you've seen in some of the reports coming out recently, provide very credible results in that area.

The second is technical expertise in project management. Again, this helps guide the project on to its right course and adds value to that project. So the more experienced people you can get into project management from the technology viewpoint, we think the better R&D comes out at the end.

An external input early in the process, not having the project be created maybe by staff and then reviewed as it goes, but actually have external input into the creation of the project, the assignment of what deliverables or end results you're looking for. And then, use that constructive feedback process in a very ongoing responsible manner. Which means that the advisory groups can have the priority -- or let's say the control to even possibly shut down some projects.

That actually helps balance the perspective and the objectivity of the staff versus the external advisors. I think that's important that the external advisors can have enough impact to say this work should be stopped or this work should be changed.

I think the CEC should look at how it can handle its commercialization application. This is one of the things as far as getting results into the marketplace to benefit society and the citizens of California.

And last, I don't have it up there, but I think experience is very important. We have found that the experience of our scientists and engineers in

managing those projects has actually benefited on a multiplicity as far as results. Their experience helps guide the projects to where it should go to, helps cancel projects easily because they see over the horizon that things are changing. And I think that experience is very important and it's a lesson we have learned that the more we can keep experienced people and experienced advisors in the process, the better the end result of the research.

That's a brief summary of where we've learned in the past twenty years and some of the key points. They are expanded a little bit more in the written text.

**MR. WEINBERG:** Any questions by the Commissioners?

**CHAIRMAN IMBRECHT:** Except for one comment I think it's probably -- you'd laid out a pretty clear indictment of one of the problems with the R&D program at the US Department of Energy, and that is the development of technologies that go on the shelf and are never taken off the shelf. And we have long recognized that and tried to fill the gap to the extent that we could here in California, but I agree with you totally that there is an awful lot of basic research that has been conducted at this point in time that has not delivered anything that the taxpayers have paid for.

**MR. COURTRIGHT:** And I think it's very important. What we've tried to do is develop a preliminary commercialization plan. You might be early in the phase of the research, but if you identify what you think is going to be the end result, what you think is the deliverable, you can get to an idea of how you would commercialize that.

And at least you start thinking that process out before you do the work,



get an end result, and then have to figure out how to get it in the marketplace.

**PRESIDING VICE CHAIR RAKOW:** Are some of the members of your advisory groups part of the commercialization process, are they actually private industry?

**MR. COURTRIGHT:** Yes. We do involve, for example, when we do work in appliance efficiency we bring in people from Maytag, Frigidaire, etcetera, to help advise that and how to get those products into the marketplace eventually.

**MR. WEINBERG:** Let me just ask one question. Having spent ten years on various EPRI advisory groups, I know that EPRI has probably the most extensive advisory group dynamic going of any organization I know of. That doesn't come without some administrative burden and cost. That is there has to be a recognition that this doesn't come for free necessarily.

How much of the total cost of an R&D project do you estimate, I don't really put you down, is involved in this advisory process, because I think that's going to be one of the those issues in the public interest question of how you really bring in the advice. No matter what you do, it's going to cost you something.

**MR. COURTRIGHT:** And I don't have a number exactly.

**MR. WEINBERG:** That's fine.

**MR. COURTRIGHT:** But I think it in terms of the end results that you get and the value that you can create, you know, if you create something in the marketplace from good R&D and it normally has a multiplier effect of many times the money invested in that R&D, I think the advisory process becomes a very small percentage when you look at the whole stream of benefits that can result.

If the advisory process isn't there and you don't get the R&D on target, you've more than wasted those dollars. I view it as a very small percentage of the cost of doing R&D when you look at the total benefit stream.

**MR. WEINBERG:** Any other questions?

**COMMISSIONER SHARPLESS:** Yes.

**MR. WEINBERG:** Commissioner Sharpless.

**COMMISSIONER SHARPLESS:** I guess I'm probably the newest one in this area, so forgive me for probably some naive questions.

But I am sensitive to the fact that we do have a small amount of money. And when I've been listening to the processes that people who have been in the business have been describing, it sounds like we're talking about a relatively sizeable administrative cost. Can anybody help me along those lines? Are we talking about a sizeable administrative cost?

**MR. COURTRIGHT:** Our administrative overhead roughly runs about 10, 11 percent. And that's managing -- that's what we call our general administrative costs which I think that we've worked to try and bring that down quite a bit. There are probably some other indirect costs in there too, but we think that's, from what we've been able to compare, fairly reasonable general administrative costs.

If you add some indirects or some training technology or people, things like that may bring that up a few more percentage points.

But I think if managed well, you can keep that under control. And that type of feedback loops even on the smallest projects, again, keeps the work on target.

And then the dollars you're investing don't go wasted.

**COMMISSIONER SHARPLESS:** There is always -- I think there is always this feeling, particularly in government, that we, you know, government is always top heavy with administrative costs. And I know that when the Legislature looks at this program, or anybody looks at this program in spending public money that the administrative cost factor is going to be a large one. How much money are we actually getting into the hands of research and development and demonstration, and how much are we spending on just the process?

I guess, you know, one of the antennas that I have up is that I recognize that you need administrative costs or else you'll waste money. But how do we balance this out to have a good process, ones that you've developed well, but we keep these costs down?

**MR. COURTRIGHT:** What we have done when we did our process re-engineering back in '94, we moved as much as can and what I would call the administrative support close to the researcher to make the work easy for them to get their work done. We tried to take away -- we moved people from what I call the central staff into the technical operations. They were side by side with the researchers and helping them write contracts, do reviews, things like that.

If you look at the processes of how you do R&D, we took out a fair amount of time. We were able to go from contracts that maybe took months to get together because the contracts people were over the wall in a contracts department. Well, we physically relocated them in the same office building as the researchers. They could walk to the next office. And we have contracts now put in place in a day

or two.

And I think if you looked at some of those processes and just don't adopt the traditional way of doing business that you can actually shorten the cycle and impact the end result quite a bit. I think that's important that the process be looked at. It looked from the people who are doing the work and do it as efficiently as possible.

**COMMISSIONER SHARPLESS:** I think the other key factor here is that obviously there is a lot of overlap between public, private and regulatory. And your processes, I think, have mixed these things together fairly well.

We are now in a situation where we continue to have the needed linkages between these that you're talking about going over the wall, so to speak. But we're going to have to I think also be in a position to justify that the money that we spend is for the public interest research and be able to identify how we've spent those dollars. That's going to get a little bit more perhaps complicated. And I think that's something that the Committee -- I'm sure both Sally and Chuck are very sensitive too.

**MR. COURTRIGHT:** Yes, One of the things we do do is our advisory structure not only from technology viewpoint is also have used the status and the development of projects, and they help us keep an eye on our administrative costs. Because they want -- it's their funds, they want their best dollar going to the bottom line for the result going to them.

So I think those advisory processes not only help technology-wise, but also from an administration-wise that you're using your funds efficiently and not

wasting them on -- or I wouldn't say not wasting, but spending them on general administrative costs rather than technology costs.

**CHAIRMAN IMBRECHT:** Okay, if I could just respond to that last point, Jan, for a second, having had the benefit of serving on the EPRI National Advisory Council for six or seven years now.

They faced some of those same questions in a slightly different vein. And that is in the context of EPRI had for many years basically had a membership fee based upon the size of the companies or the entities that were members, etcetera. But it was a one-size-fits-all kind of package. And then they provide opportunities for what Hank's referred to as tailored research.

**MR. COURTRIGHT:** Yes. We have what we call a tailored collaboration for --

**CHAIRMAN IMBRECHT:** Tailored collaboration. And in essence, the question was: What comes out of that? Should that be made available to all the EPRI members? This is sort of a question of does public goods R&D, does it become public domain exclusively? Or, is there some balance with proprietary issues.

Something we've struggled with with our own R&D programs in terms of attracting participation from the private sector, and to what extent that participation then is going to in turn enrich their competitors. And so that's clearly one of the issues that we're going to have to deal with in this entire endeavor.

The other thing I would say in terms of the advisory process that I think is beneficial and it's somewhat subliminal, but I think very important. And that is that if EPRI or any other research organization were to simply open the black

box at the end of the process and say, “Here’s the widget that will solve this problem,” you are not really giving advance notice to the marketplace, nor are you generating buy in, if you will. I think that consultation process has been very useful.

And I use the example Mr. Courtright used, and that is appliance efficiency. You’ve got a lot of buy in from the industry by virtue of the fact that they were kind of brought along with the process that EPRI was involved with.

So I think we ought to keep our eye on that benefit as well.

**PRESIDING VICE CHAIR RAKOW:** Mr. Courtright also mentioned the process and how they revamped those. That is something that we know, that we’ve been looking at our contract process and RD&D. We know it has to be re-done, and we hope to have the part in the administration in figuring out ways to overcome some of the barriers in the contract process.

**MR. COURTRIGHT:** Just to share one of what I think the successes was of physically moving the contract people from a central office location to the same hallway as the researchers ended up that the researchers could walk down and negotiate a contract across the table with a contract person instead of sending it through the mail or by e-mail.

And it was amazing how when you had what I would call a research team was put together, that people could deal all the way from the very beginning of the project, not only the technology people, the contracts people, the people who have commercialization expertise, get together early in that stage rather than in a series of events. And that made a huge difference I our time to do R&D.

**PRESIDING VICE CHAIR RAKOW:** Thank you.

**MR. COURTRIGHT:** Thank you.

**MR. WEINBERG:** Good to know there are some things that still work better not on the Web.

[Laughter]

**MR. WEINBERG:** The next person is Dr. Jim Cole who is a director of the California Institute for Energy Efficiency, CIEE. It's part of the University of California and it plans and funds and manages a statewide program of medium to long term applied research aimed at advancing energy efficiency and the productivity of the end use sector in California.

It's good to see you again, Jim.

**DR. COLE:** Thank you, Carl.

**MR. WEINBERG:** I even go so far back as to know when Jim first got here.

**DR. COLE:** Thank you.

Today I'm going to represent the perspective of the management of the California Institute for Energy Efficiency. The Institute is an organized research unit of the University of California, but I'm not going to try to represent the perspective of the University of California on all of these matters.

The University does manage a number of industrial, university, government R&D programs such as in the microelectronics area and the biotechnology area and other government research programs such as breast cancer research and tobacco related health effects. This experience may be of some use to the Commission in their efforts to look at the management of R&D programs, and

there may be value in contacting the University of California representatives. I'd be happy to put you in touch with them to the extent to which you're interested in tapping that broader perspective.

But I'm only going to represent the perspective of CIEE and to the extent to which its research board of directors have dealt with specific issues, that perspective as well.

The funding for the Institute is provided over the 1990 through '97 time period from the California's major electric and gas utilities. We've also had some Petroleum Violation Escrow Account funding administered by the California Energy Commission.

Funding has been provided to CIEE at the request of the Public Utilities Commission. CEC support was very important in the early stages of establishing the Institute, and most recently in the PG&E and Southern California Edison rate cases.

The technical and policy guidance for the program is provided by a research board that consists of vice presidential level representatives of the utilities; the Electric Power Research Institute; the California Building Industry Association; a California Public Utilities Commissioner is also on the board; California Energy Commissioner, Commissioner Sharpless currently represents the Commission on our board of directors.

Based on -- first slide, please. Based on policy guidance provided by the research board when the institute was established, CIEE's role is to plan, fund and manage a statewide end use efficiency R&D program whose goals are summarized on the slide there. To develop new end use efficiency technologies and knowledge



about how to apply these technologies to meet customer needs for high quality energy services.

An integral component of the mission is to use the capabilities of leading scientists and engineers at California's universities, colleges, national laboratories and other affiliated laboratories. The board conceived that the capabilities of these researchers could be used to develop the next generation of end use efficiency technologies using a systems approach.

For example, in a particular building end use efficiency application in heating, ventilation and air conditioning, the most cost effective approach may be to reduce the fundamental cooling, heating and ventilation load on the building and use the most efficient and cost effective electricity or natural gas or other energy source to supply the remaining load.

And that that integrated approach is very consistent with the public interest R&D objectives of the program that the Energy Commission is putting forward.

And third, the board can see that if CIEE developed new technologies that they could be further developed and commercialized through the utility R&D energy efficiency programs, market transformation programs in cooperation with other industry. So we reviewed as a compliment to the R&D programs of the utilities over the '90 through '97 time frame. Of course that situation is changing in the future, perhaps as we move forward.

The board encouraged CIEE to plan, fund and manage three types of projects that are shown on this slide. Large, on the order of 250- to \$350,000 per

project annually, mission oriented multi-year projects. Initial emphasis was to be on building energy efficiency and the use of energy efficiency technologies that would also improve regional air quality.

We are currently managing nine multi-year projects. Most of the funding about next year about 77 percent of the funding will go into the multi-year focus program.

So that we don't over plan the program and provide opportunities for promising ideas to come forward, we also fund an exploratory research program. We issue a solicitation annually and fund on the order of four to ten exploratory projects at the level of about \$60,000 a year. This is selected through a competitive peer review process.

And lastly, a small amount of funding on the order of \$100,000 a year is made available to the director to fund a small 20- to \$50,000 level projects that sort of come up between the exploratory program. And we've had successes in all of these areas.

Next slide, please.

The multi-year research program focuses initially on researching opportunities for improving energy efficiency. For example, several years ago there was speculation that thermal distribution systems in residential homes weren't performing very well.

So in the initial stages of a multi-year project, Mark Modera, who's going to talk to you later today, went out and measured very accurately the performance of these systems in a cross section of residential homes in California.

And sure enough, he found major problems. Major opportunities to improve efficiency.

In the second stage of the project he went on to begin the process of developing new end use efficiency technology that would improve the performance of these systems in existing buildings. He's also conducted research over the past five years in both looking at other opportunities for improving efficiency using other approaches in existing homes as well as in new homes.

So we have a very broad based program in that particular project area that essentially covers all of the elements that are shown in this slide. So it's not just a serial process of going from one stage to the next, but each phase of a multi-year project may involve components across this spectrum.

Each multi-year project has a project advisory committee that consists of not only the utility, Energy Commission and other sponsors, but industry people. And many of our projects are involved in the advisory committee. They help guide the conduct of the project. They help provide feedback on the next phase of the project and what would be productive directions. They're an early pathway for technology transfer. So they are very important mechanisms at the project level if you undertake large mission oriented projects.

The planning process starts by the board establishing -- could you go back to the previous slide, please?

The planning process starts by the board establishing funding levels for the various program and activities shown on this chart. The board also approves the planning process. That process has changed somewhat over the years. The

board in '94 established a process that we not only followed in 1994, but are following in 1997. And I'll talk about that process in a moment.

The board also established a planning committee. This consisted of R&D and energy efficiency program managers within each of the sponsors. And recently we've added representatives from NRDC; BOMA, the Building Owner and Management Association; the National Association of Energy Service Companies; and the South Coast Air Quality Management District to provide a broader perspective on our program.

The board requested that we work with the planning committee to update a set of decisionmaking criteria that we use for looking at all of the projects. The board expects the CIEE and the planning committee to review the scope of the next phase of the R&D project in terms of the scope of work, the deliverables, products, the schedule, all of that.

The planning committee talks to the project advisory committee representatives to get some feedback on how the project is going. So there is the interplay between the various levels.

We also talked with the planning committee about possible new projects. What are new opportunities to improve energy efficiency? What would be the potential objectives of the project? And what would be the anticipated funding for the initial stages of the project?

We work with the planning committee to sift through both funding existing projects and new projects. We make a recommendation to the board. And usually the board will approve the recommendation.

In terms of launching a new project, there's further efforts to conduct scoping studies and workshops to reach out to both the scientists and engineers and private sector people to review the state of the art, to refine the objectives of the project. We usually issue an RFP and we go through a competitive process.

I think I'd like to -- so that's how we conduct the planning effort. I'd like to sort of sum up with what the lessons learned from the program.

We have had a very successful program as represented by a report of the independent review panel that reviews our program periodically.

Stable sources of funding are very crucial to the success of a program. A supportive board of top executives and commissioners who are interested in guiding the program and trying to achieve customer benefits; the ability to tap the capabilities of leading scientists, engineers; and, of course, industrial R&D programs. You need to avoid burdensome contracting and other requirements. You need to provide a supportive environment for the project.

A stable, experienced R&D management organization is very important to be able to attract talented people, provide stable environment in which to work. You need technical and market guidance on the conduct of the project. We've talked about that at both the board, the planning committee and the project advisory committee level.

You need affective outreach to board and policy makers to demonstrate what the value is that you're getting from the program so that you can continue to obtain support for it. And you need periodic independent peer review of the program.

Sorry I took a little bit more time, Carl. Appreciate the opportunity.

**MR. WEINBERG:** Any questions from any of the Commissioners?  
Commissioner Sharpless?

**COMMISSIONER SHARPLESS:** As Jim indicated, I sit on the CIEE board and have been very supportive of both the process and the programs.

But there is something very unique about this board, Jim, and that is the fact that it essentially took ratepayer funds from the utilities, and the utilities were very much involved in identifying research priorities along with some of the regulatory and some of the municipal participants.

However, it's been sort of a closed school, and you're beginning to try to open it up with other interest groups. I guess the real point that I want to explore with you is currently most of the research that's done by CIEE is done by the capabilities of the University and the National Labs. The research participants don't go beyond that.

If your program were to be opened up and allow other researchers to participate in this, do you see that you would have to make any significant administrative changes?

**DR. COLE:** No, I don't think we'd have to make any changes at all. Again, that decision was made by the board when CIEE was established and I think the University conducts other industrial research programs that involve both the scientists and the industry as recipients of the funds.

So I think that the University -- I can't speak for the University, but my sense is from contacts with them is that they would certainly want to administer a

program under the guidance of a board of directors that is describing how we should plan and manage the program.

**COMMISSIONER SHARPLESS:** And you also indicated that one of the goals is to develop new technologies. We've heard from PG&E and EPRI that there are some problems with organizations getting into the new technology realm. Is there any advice from that aspect that you could impart to the Committee about what to look out for in developing new technologies?

**DR. COLE:** I think you need to look at the infrastructure that will be there in the future. It will be the energy efficiency programs that are funded with public interest funds focusing on market transformation. We've already been very successful in linking our program to the PG&E market transformation program. I think we're seeing a number of our technologies that PG&E is thinking about deploying through that program.

And I think that to develop that infrastructure, the relationship between the public interest R&D program and the public interest energy efficiency market transformation programs is at least one of the keys that we have to work very hard. But it's beginning to happen and I think we can nurture and develop that.

**COMMISSIONER SHARPLESS:** But Mr. Cole, that's changing too. I think that's another important point that CIEE has been able to take what it's learned and it's projects and put it back through the utilities.

If there are more actors out there and if utilities are not performing the same function, then those kinds of things will have to be looked at.

**DR. COLE:** Well that's a broader based program than just utilities. I know the CPUC is examining how that program will be administered, trying to encourage energy service companies and others to get into the game.

We certainly want to open up the California Institute for Energy Efficiency to energy service companies and other participants to facilitate that process.

**COMMISSIONER SHARPLESS:** Thank you.

**COMMISSIONER ROHY:** Jim, I'd like to ask a question along the line of Commissioner Sharpless. One specific area in the technology transfer area it's very important to deal with intellectual property rights, and I'd like some input from you in how you deal with intellectual property rights or how you plan to as we get into this wider world of ESCOs and other people who will actually do the market transformation and take product to market.

**DR. COLE:** I think that our program the ownership stays with the performing institution and the CIEE board has first right of refusal on -- or one of the their agents has first right of refusal on transferable licenses.

I think the issue is we need private sector investment in the technology to take it from the stage where we have a patent or a copyright or software, and that's the key. If someone is willing to come forward and make a significant investment and has the ability to take it into the marketplace based on the best judgement of the participants in making that decision, then I think that's what you want to do is allow them to have a time limited exclusive license or non-exclusive to take that technology.



But the key is the investment of their people and their financial resources.

And so I think it's not appropriate in my judgement for the funding organization to own the intellectual property. What are they going to do with it? They may not have the expertise to move with it or whatever.

I think the ownership remains with the performer. They have an incentive to make it go, as well as perhaps private sector investors, to make it go. And that's the policy that I would encourage people to think about.

**COMMISSIONER ROHY:** Thank you.

**MR. WEINBERG:** Jim, I'll let you off until after the rest of the panel is done.

**DR. COLE:** Thank you.

**MR. WEINBERG:** The next presenter is Janet Joseph who is a manager of research planning for New York State Energy Research and Development Authority, NYSERDA. And this is a public benefit corporation that was created by the New York State Legislature in 1975. Still very active. Provides technical and financial assistance to help develop technologies that help businesses, municipalities and residences to save energy, reduce energy-related environmental impacts and to grow high value added manufacturing businesses in New York. So you see bring into the goals some of the aspects of economic development.

Janet?

**MS. JOSEPH:** Okay. Thank you.

What I'd like to do this morning is briefly give you a little bit of

background about NYSERDA and then focus in on those elements that we feel are most critical in developing and delivering a successful public benefit program.

As Curt indicated, we are a public benefit corporation. We've been around for about 20 years, established by the State Legislature in 1975. Our enabling legislation gives us broad authorization to use technology and innovation to solve some of the state's most difficult energy and environmental related problems.

The key to our enabling legislation is that it is broad enough to allow us to be flexible and to respond to changing needs.

Our primary statutory responsibility is to support research and development in energy technologies. We do have other functions which I've listed here and are described in our annual report and program plan, and I've brought some copies of that for the Commissioners and I'll leave them with you, Mike, for distribution.

We plan, fund and manage a public interest energy R&D program with three primary goals:

One, promoting energy efficiency and the development of new energy and environmental technologies to advance economic growth;

Two, developing the state's indigenous and renewable resources;

And three, reducing environmental impacts associated with the production and use of energy.

We are governed by a 13-member board of directors. And I've identified the composition of the board right here. The key point is that this is a board of stakeholders, and this board ensures that the views of major stakeholders

in the state are factored into our program and that we design an R&D program to be responsive to stakeholder needs.

The Governor does review all major actions of the board and we do get some input from our energy planning board.

NYSERDA is funded by an assessment on the sales of gas and electricity. We also get a voluntary contribution from the New York Power Authority and we get some NYSERDA corporate funds from interest earnings and royalties and recoupments.

Our base funding, which was about \$18 million last year, was leveraged about three-to-one with outside co-funding. We brought in \$56 million worth of co-funding to deliver a \$75 million program for the State of New York.

Over the past ten years we've averaged about a three-to-one co-funding ratio for our programs. We feel that a co-funding ratio of about one-to-one to one-to-three is appropriate for us. It indicates that there is true interest on the part of technology developers and end users in the projects, and yet it's not too large to indicate that our money isn't critically needed to make the project happen.

Our program is developed through a multi-year planning process that is overseen by the program planning committee of our board of directors. We have a program planning committee that meets three times a year to review any changes in direction of our program, to go over our strategic vision, and to discuss budgeting issues.

When we develop a new program or a new subprogram, or even specific projects, we look at the following criteria that I've laid out here:

Contribution to achieving our state energy goals; benefits in energy, environmental and economic terms; technical engineering and economic feasibility; and relationship to existing NYSERDA programs. That's kind of a portfolio issue. We look at how a new project or a new program fits into our total portfolio.

We also look at the relationship to other R&D programs. As a state entity, we have to make sure that we are not reinventing the wheel, we are not duplicating efforts. So we try and make sure that our programs build off the work of others, build off the work of EPRI, DOE and are done in concert with some of the other activities done by other state energy R&D organizations.

In addition to assessment of technical opportunities by staff at NYSERDA, in the policy direction that we get from our board and our program planning committee, we have extensive stakeholder input into our planning process. And this goes along with some of the things that Hank and others talked about in terms of bringing people into your R&D process very early on.

We convene one to two external review panels each year where we look at a particular subprogram area at NYSERDA whether it's alternative fuel vehicles or renewable energy. We bring in outside experts to review our program, future directions and develop research plans. Chairman Imbrecht and other distinguished energy professionals have served on these review panels.

We also hold scoping sessions, as Jim Cole mentioned in his program, to plan programs in new and changing areas.

For example, a few years ago we launched an indigenous natural gas resource program. We brought together the major stakeholders in the state,

industries, we looked at research gaps, identified some research needs, developed a research plan, and we are proceeding along implementing that plan with full buy-in of the industry. And it has been quite a successful program.

The scoping sessions that we do seem a little bit similar to what the CEC currently does with some of its focus groups in the targeted technology areas. The only difference that I can see is that we tend to view things a little broader. We look at it perhaps a little broader of a scope.

And we basically try to cover our entire research program with difference scoping sessions. We do about a dozen of these scoping sessions a year.

We also meet at least on an annual basis with our utility R&D directors to ensure that our programs are complimenting what the utilities are doing. And we focus quite heavily on coordinating with other government and private research organizations.

We have good working relations with EPRI, GRI and with many of the other state energy R&D organizations that are represented by ASERTTI. That's the Association of State Energy Research and Tech Transfer Institutions.

In fact, next week several members of this panel are going to meet with DOE to discuss how we can collaboratively plan a coordinated federal/state energy R&D program.

Now NYSERDA's program is divided into five areas that reflect the primary end use sectors in New York State, as well as energy needs. Industry, buildings, energy resources, transportation and environmental research.

This chart illustrates our anticipated spending profile aggregated over a

five-year period as laid out in our program plan. You can see that our program covers a number of very different types of research elements from drinking water to heating and cooling systems to solar technology.

This sort of programmatic division on the basis of end use has evolved over the years. At various points in our history we divided our program more on the basis of technology. We feel that by dividing it on the basis of end use sector we can better reach targeted audiences.

Okay. Now NYSERDA does not conduct research internally. We contract with a number of firms and municipalities and universities in the state. This chart illustrates the primary beneficiaries of our program. You can see that we deal quite heavily with businesses in New York State to help them address their energy problems, and also to help them develop or refine energy technologies that will serve the needs of all New York State energy users.

We do look also at portfolio issues in our program and try and maintain a balance between some nearer term commercialization activities and some longer term technology development that's represented by our work with the universities. And we feel that this is very important for a public interest entity.

**CHAIRMAN IMBRECHT:** Excuse me. If we could go back to that chart. When you say "residential sector" are those businesses providing services for the residential sector or --

**MS. JOSEPH:** These refer to specific projects that we have dealing with the multi-family and low income sector in New York State, which is an issue that we are very much concerned about.

**CHAIRMAN IMBRECHT:** And who actually receives those dollars and performs those services?

**MS. JOSEPH:** I varies. We do some work with our Department of State which handles some of the weatherization activities. We do some work with businesses that are providing services for the Department of State. Some perhaps building associations, those might be the typical clients, if you will.

**CHAIRMAN IMBRECHT:** Thank you. I understand.

**MS. JOSEPH:** Okay. Some other characteristics of our program that are worth noting, we are a very market driven program. We tend to shy away from pushing a particular technology or trying to pick a technology winner. We try to use our financial and technology resources to encourage or entice the private sector into investing in the areas that have public benefits as well as private benefits.

We view our role as one of optimizing, improving efficiency, assessing technologies, comparing technologies, and helping end users make better decisions and helping policy makers make better policy.

We believe wholeheartedly in public/private partnerships and co-funding. This gets at the issue of: How do you make sure your R&D doesn't just sit in a final report or sit in a patent and never get used? We get the end users and industry involved in our program at the very early stages of development starting with our scoping sessions, working all the way through the project implementation.

Competitive solicitations. About 85 percent of our program is competitively selected. We tend to issue solicitations in each of the subprogram areas that I illustrated in the five-program chart. We have about 25 subprogram

areas.

Our approach to compared to some of the existing CEC activities by issuing competitive solicitations in our subprogram areas we tend to be more focused then you might be in your energy technology advancement program, but not quite as targeted as you are in some of your targeted programs where you pick, you know, seven or so different technologies.

We do have a focus on commercialization as I indicated earlier. We have a two-tier recoupment approach which we believe is appropriate for a public interest organization. If we work with a company to develop a product and they move out of state, they have to pay a higher recoupment provision to NYSERDA. This is one of the ways that we try and keep our homegrown businesses in the state.

Outreach I mentioned earlier, and peer review. Very critical to our program. We used peer review at the project level. We bring in outside experts to help us select projects received in response to solicitations. We bring in technical advisory groups to help guide with the implementation of a project. We have final reports reviewed by peers.

We review our programs through our annual external review sessions, and we even review our processes and our ways of doing business. We have periodically brought in stakeholders and clients to look at our contracting, our recoupment and those sorts of things. And this is helped us very much to streamline our process.

Okay, last slide.

Okay. To summarize, I've tried to identify here kind of our five factors



for success:

Open and integrated planning governed by stakeholders.

Competitive selection of projects and programs. We believe it's been very important to NYSERDA's program.

Timely and efficient delivery of program services. You can have the best program in the world, but if you can't get in front of your own contracting process you'll never get the benefits out there. So this is very important.

Stakeholder involvement in implementation. A key to commercialization. A key to jumping that wall, and this is kind of a consistent theme that I think is coming up all morning.

And finally, program review and evaluation. External peer review. We believe evaluation will be very important as we move into the competitive industry. There's all sorts of speculation right now as to what the private sector will do and what it will invest in, what it won't invest in.

We will need to periodically look at our public interested programs, assess what the market is providing. If the market is providing certain services, then perhaps certain public interest programs should be scaled back. If new gaps emerge, then the public interest program must address them.

We believe these have been the key components behind our stable program and successful program in New York State.

I thank you for your attention.

**MR. WEINBERG:** Thank you, Janet.

**PRESIDING VICE CHAIR RAKOW:** Just a very quick question. Does

New York State give any type of an investment tax credit to the private sector?

**MS. JOSEPH:** We have a credit for investment in renewables right now. And I believe, but I've had to check into this, there is an investment for research and development. But I will have to check into that.

**MR. WEINBERG:** Any other questions?

**CHAIRMAN IMBRECHT:** Just a couple quick comments.

There's no question for many years your program and ours have been quite complimentary I think in general direction. There has been a lot of interaction between the two, and certainly they have been on the state level a most sustained with a broad reach.

I'm sorry, I was was momentarily distracted when you were explaining your funding source. Could you go over that again for just a moment?

**MS. JOSEPH:** Yes. We are funded by -- if I can find that slide -- an assessment on the sales of gas and electricity. And I've put the rates right down here for you. Typically about less than .1 percent of utility revenue. It is electricity and it is gas.

We also get a voluntary contribution from the New York Power Authority and some NYSERDA corporate funds from interest earnings and royalties. Those are our primary funding sources right now.

**CHAIRMAN IMBRECHT:** And how much do you get from the Power Authority?

**MS. JOSEPH:** We've been getting about three million a year and it's scaled to a comparable level of the other investor owned utilities.

**CHAIRMAN IMBRECHT:** And do they target that since they are heavily nuclear based authority --

**MS. JOSEPH:** No, they basically --

**CHAIRMAN IMBRECHT:** They throw it into the pool and it's up to you to decided how to --

**MS. JOSEPH:** They throw it into the pool and it is subject to our planning process, our competitive selection. They do not specifically control.

**CHAIRMAN IMBRECHT:** I noticed a number of your or two of your research categories had a nuclear connection, as I recall correctly.

One other question. In addition to this, have you attempted to identify what the magnitude of public goods R&D is that is funded through the rate base of your utilities? Or is this their principal activities in this arena?

**MS. JOSEPH:** Yes. We are in the process of doing that right now as part of ongoing discussions with our public service commission. We estimate that there is about 32 to \$36 million worth of electric investor owned public benefit R&D taking place in New York State right now. And that includes the electric portion of NYSERDA's program.

**CHAIRMAN IMBRECHT:** That includes.

**MS. JOSEPH:** That includes.

**CHAIRMAN IMBRECHT:** I see.

**MS. JOSEPH:** The investor owned electric portion of our program is about ten million. So we see about 20 or so million taking place in our investor owned utilities. And that includes some activities in EPRI, a portion of the EPRI

contribution.

**CHAIRMAN IMBRECHT:** Mr. DeAngelis, in the context of future discussion on these issues, obviously we aren't going to decide them today, but I think it would be useful, New York being the second largest state in the country population wise, and probably most comparable that we try to get a handle on tying down some of those numbers for comparison purposes.

**MS. JOSEPH:** Actually, if you scale your \$60 million program to population it comes out to be about 35 million. So on the basis of population in --

**CHAIRMAN IMBRECHT:** Are we that much bigger than you now?

**MS. JOSEPH:** We are 56 percent the population of California.

**CHAIRMAN IMBRECHT:** My word.

**MS. JOSEPH:** On the basis of energy use as well as population the numbers that you're kicking around are quite comparable to what we're coming up independently in New York State.

**CHAIRMAN IMBRECHT:** The only difference being is that the 62,5-- does not include the existing R&D programs of the Energy Commission. It would be in addition to those.

**MS. JOSEPH:** Okay. That is a difference.

**CHAIRMAN IMBRECHT:** And NYSERDA is included within that number.

Okay. Thank you very much.

**MR. DEANGELIS:** I think another appropriate question is what was the public interested RD&D several years ago, also?

**CHAIRMAN IMBRECHT:** Very good.

**MR. WEINBERG:** Any other questions?

I have one, Janet, and this is by rule of thumb. You said that the program is 18 million but you bring in other dollars and get about \$56 million I guess that you're managing.

**MS. JOSEPH:** It's actually about 75 million that we're managing. We brought in another 56 million in co-funding.

**MR. WEINBERG:** I have a broad rule of thumb that says it takes you about one person per million dollars. That an organizational structure to manage 70 million takes about 70 people.

**MS. JOSEPH:** Well, we have 35 people in our R&D program to manage this, so we are one-third of that, or one-half of that rather.

**MR. WEINBERG:** Thanks.

**MS. JOSEPH:** Thank you.

**MR. WEINBERG:** The next presentation is from Mr. Mark Hanson who is the Executive Director of the Energy Center for Wisconsin. Mr. Hanson also participated in the Commission's hearing in January 31, '95, which actually it started to look at public interest R&D and under the restructuring scenarios.

And the mission of the Energy Center of Wisconsin is to sponsor and conduct research in the efficient use and management of energy and to develop and demonstrate the transfer of the results of the research to Wisconsin's energy service consumers and providers. This Center was founded in 1989, so it's got a few years under its belt already.

Mark.

**MR. HANSON:** Thank you. I do have some copies of remarks that I'll share with you. I understand that more copies are going to be made for those of you in the audience. They may have been made already.

The Energy Center of Wisconsin, hereafter referred to as the Center, is a private not-for-profit research development and demonstration organization. The Center's mission has already been stated, but you will note that it is broad in terms of research, demonstration, outreach, training and so on. And it is for both the providers of energy services and the consumers of energy services.

We work closely and collaboratively with government organizations including the Public Service Commission of Wisconsin, businesses, research and development organizations, consumer and environmental advocacy groups, and Wisconsin's electric and gas utilities.

By its very nature, public interest RD&D is or should be a collaborative effort. It seems difficult to make the case that RD&D is for the public interest, but then not include a broad spectrum of interested parties in the governance of the work.

The Center has, in my estimation, been rather successful to date in bringing a diversity of stakeholders into processes, its processes through which the public interest RD&D is identified, funded and brought to fruition.

While the Center has been able to accomplish this, it is also evident that the restructuring process that is commenced in Wisconsin will probably require that some of the funding arrangements for the Center will be changed to

accommodate the advent of some type of systems benefit charge.

Currently, the Center is funded primarily, about 75 percent, by its utility members on a voluntary basis which uses a formula based in part on equal cost sharing for members with board seats and on the number of meters that the members have. It comes out to about 75 cents a meter per year in Wisconsin.

Restructuring will also alter the mix of RD&D and may add new functions to the Center's activities, such as the design, oversight and evaluation of public interest energy efficiency services. Now this is beyond RD&D, but the actual service delivery on a competitive basis.

I would note that the energy services marketplace is changing dramatically. Thus there is great uncertainty as to how well the marketplace for energy services is really going to perform during and after the transition.

Because the utilities are increasingly being viewed as self-interested agents, however, they are rapidly giving up their role as objective neutral providers of energy service information. There already is increasing demand for neutral sources of objective consumer information.

So I think the point that that last comment makes is that while we certainly are involved with public interest RD&D, we are also looking at services such as training, consumer information and so on. That goes beyond that into other areas of market failure including high transaction costs for lack of information, market power and other things. So we see the demand for our services and the delivery of our services expanding, and they've done so markedly in the last two years.

Let me comment on I think what are the four central features that have led to some of the success that we've been able to achieve in the last two years in particular.

One, I would emphasize the collaboration. We have a 12-member board. Five of which are investor owned utilities, one represents municipal utilities, but then there are two public interest groups represented, trade allies, a public service commissioner, and two university faculty.

This representation on our board is represented in our key committees, including our two main advisory committees, our research advisory committee and our demonstration advisory committee. And these committees in this collaborative manner on an annual basis define about 50 projects and about 35 training events and workshops that we in the current year will be undertaking.

And thus we define these needs on an annual basis. We say, "What are the funds needed?" And by our formula our members then contribute on a voluntary basis those funds, and we execute this program.

So it's a very open collaborative process, and I believe this is key to some of the success that we've been able to achieve.

The second factor that I would note of great importance is flexibility. We are accountable as a private organization to our 12-member board and to no one else, at least in terms of any direct accountability.

I would note that as part of doing this flexibility that we do some work in-house as well as considerable amount of out sourcing on those 50 projects.

During the course of the year if we've decided a board approved project



no longer makes sense, we end that project or we don't start it. If we see projects that have emerged that are a terrific opportunity, we scramble to see where in our budget that we could pull those funds to go after that project.

One of the projects that came up unexpectedly last year was in the biopulping area. We went from inception of idea to contract in six weeks and we contributed 150,000 to a commercial demonstration in a paper mill that is ongoing at this present time. This was after, I would add, nine years of research and \$6 million of funds.

For this contribution we also gained license rights that if this goes to commercialization will fund future research at the Center. So we are able to participate and own intellectual property rights.

I would add we do not have any contract managers. Our project managers are expected and they pull contract forms off our network, computer network. If they have doubts they call our outside counsel. They then work it out, they bring it either to myself or our associate director, and we look them over and then they go. So that's the next step in streamlining perhaps.

We rely in this collaborative area -- and this is my third point -- on a highly transparent project and budget information tracking. On a monthly basis we have updates on the technical progress and financial progress of our 50 projects. This is summarized on one spreadsheet for our two main advisory committees, and our board if they are interested also looks at it on a monthly basis. But they rely on their representatives on our advisory committees really.

We also published that information on our Web page. So if someone

wants to see on a monthly basis, “Well, has that that project been contracted? How much of the expenditure has been made? Where does it stand?” They can hop on the Web page and see where it is or get our hard copy forms.

But this is critical in this wide open forum the folks know what’s going on and therefore they’re not being -- they are not suspecting us of gaming situations or that if your public interest group, be the utilities are powerful and they’re doing some things behind the scenes and they can’t see it, or the utilities are maybe suspect of the public interest groups or the commission staff. It’s right out there. The game plan was set out. Now we are tracking it. Go take a look if you want to see where it’s at.

Our last and important feature I’ll mention is our rapport with our members and consistency. We have rather extensive project manager guidelines. Thus, we want consistency from project to project as we interact with our members.

And we expect that our project managers and other Center representatives will be working closely. We have annual visits to all of our members. We just finished a -- and sometimes we aggregate smaller members into groups and we just finished our cycle of 26 or 27 visits with our various members as part of this annual planning process for our FY98 plan that we are now developing.

The vision that I would have for the future in public interest RD&D is that this is going to be a distributed multi-leveled public interest RD&D network. There are things such as the Energy Center of Wisconsin and other ASERTTI members that we are, to be I think frank about it, we are much closer to our members than national organizations. And thus, we have considerable

comparative advantage in these areas. And we can be interacting with them, hearing their needs and delivering things out to them. And it will be customized for, in our case, Wisconsin or perhaps even parts of the state.

On the other hand, as a smaller organization we have about 28 employees, 14 or 15 project managers at the present time. We do not have some of the resources and skill sets the national organizations have, thus we find very good partnerships with EPRI, with GRI and with our other ASERTTI members and have found this to work well. And I expect this to be a more flexible and more interesting area of cooperation as we move ahead. And as Janet Joseph already alluded to, ASERTTI members are meeting with the Department of Energy next week to work on just the plans for this kind of a future that I think that we will be seeing.

I would note, in just concluding my remarks, four examples of projects that we have undertaken that gives you a sense of the spectrum of work that we're doing. It covers both public interest RD&D, but also addresses some of the market failure issues.

Biopulping I've already mentioned.

The second project has been artificial neural networks where we've been working with our gas utilities in developing short term gas forecasting models using artificial neural network technology and are testing this is most of our gas utilities in the state. And I would add to great result.

We've been finding small errors in short term forecasting given the nature of the market, the gas is a short term market, leads to very large expenditures. And thus, well, we found maybe a percent and a half error that we've

been able to reduce in those forecasts. The revenue consequences are much larger than that. And all for a rather modest investment. And that was partnered with GRI.

We are working on some green pricing. And I think one of the, as we've discussed portfolio requirements in renewables, I think one of our most interesting projects is a study looking at willingness to pay for green power option. And we are asking one set of our sample the hypothetical question; we are asking the other set part of our sample what is -- we give them the actual offer.

And we hope with this research to, one, both understand the uptake on actual offering green pricing and willingness to pay more, but also to be able to calibrate between what is the hypothetical question and what is the actual question which is long since been a thorn in the side of researchers in this area. If you ask just the hypothetical question, you are guaranteed to get an overestimate.

And finally, the last program I'll mention very much goes to the market failure area. And as we were working on a comprehensive residential services program that we suspect will down the road will be rolled out around the state on a consistent basis, average income and low income recipients, and that will be guaranteed that at least every household in the state will receive this offer. Some of it will be public funded, others of it will be on a for-fee basis. Much of it will be on a for-fee basis. And it will be delivered through the private contracting network and with our community action programs particularly in the low income areas.

But that gives you some sense of the diversity of our programs.

Thank you.

**MR. WEINBERG:** Commissioner Sharpless.

**COMMISSIONER SHARPLESS:** Way back in the beginning I believe you said at this time most of the funding to your agency is voluntary?

**MR. HANSON:** Correct.

**COMMISSIONER SHARPLESS:** Does that then have any impact on the type of projects that you fund?

**MR. HANSON:** It certainly has an influence on it. It's hard to measure that influence.

The way we come up with our project ideas in our planning cycle is we take ideas from all sources we can get it from. Our last newsletter that went out, had 3-, 4,000 copies, had a form right in the newsletter.

We also get it from our member visits. Certainly our members at the committee meetings.

We take these ideas and run them through a blind process so they don't know who's coming up with different ideas. And the marketplace has become so convoluted now that our utility members, as an example, often surprise each other with the ideas they are coming up with.

So it's very hard to have a whole lot of gaming going on. So I have no doubt there is some influence, but that is our process right now.

**COMMISSIONER SHARPLESS:** Okay. And I don't think I caught the level. Is it a consistent level from year to year? Since it's a voluntary program do you have a consistent level of funding from year to year and is it multi-year research?

**MR. HANSON:** Well, we have multi-year projects, but each year we have to verify that: Are we going to put money into this project for the next year? If not, we always have the option in our standard contract, 30 day notice, this project is over.

**COMMISSIONER SHARPLESS:** What is the consistency of your funding?

**MR. HANSON:** Well, the last two years it's been about 4.2 to 4.5 million that actually shows in our books. There is a lot of funding on our various projects we're involved with that does not show on our books.

**COMMISSIONER SHARPLESS:** Sort of an in kind service?

**MR. HANSON:** It can be in kind service, but some of our projects -- we have one project at a paper mill where we've got about 25 million of engineering involved and they have about 700,000 investment dollars involved. The 700,000 does not appear in our books.

But in terms of what appears in our books, it's been a fairly constant of about 4.2 to 4.5 million in the last two years, and my anticipation for next year would be a similar amount.

**COMMISSIONER SHARPLESS:** So I don't think I quite got the answer to my question. So do you have consistent funding since you were organized in -- was it 1989?

**MR. HANSON:** Well, at the beginning we were much smaller and indeed there were two organizations, the Wisconsin Center for Demand Side Research and then a demonstration organization. They grew, and about two years

ago their combined budgets of 5.8 million were merged when we put the Center together as one organization at about 4.2/4.3. It has been consistent since then, but we have no guarantees that it will be consistent in the future.

**COMMISSIONER SHARPLESS:** Do you go for grants and foundation money?

**MR. HANSON:** Yes, we do. So that's the other 25 percent that appears in our budget. It's about 75 members, new contribution, 25 percent other sources.

**COMMISSIONER SHARPLESS:** Thank you.

**MR. WEINBERG:** Any other questions?

**COMMISSIONER ROHY:** Short comment. If you could provide us with your Web page address I'd appreciate it.

**MR. HANSON:** I'd be happy to.

**CHAIRMAN IMBRECHT:** Just one question from me, and that is your first point on page 2 relative to the demand for neutral sources of objective information. Does your public service or public utilities commission require customer coding of utility customers?

In other words, we have a system here in California that is jointly enforced by the two Commissions that requires a seven-digit coding of all customers in the state and allows, with some laborious effort but nonetheless it is capable of pulling out very specific information of customer classes, subclasses, types of businesses, that type of thing. Do you have anything comparable.

**MR. HANSON:** To my knowledge on a consistent statewide basis, no. Our utility members do have coding, at least many of them do. I'm not sure all of

them do at the three or four digit SIC level. But to my knowledge, and I'd have to probably verify this with one of our project managers, to my knowledge it isn't a consistent set that is maintained over time across all our utilities in the state.

**CHAIRMAN IMBRECHT:** Well, one of the issues we are going to have to confront to some extent, not just in the context of this discussion but in some of the broader issues is the extent that there is a need for market facilitation and market development. Since those codes have been funded through the rate base and have not come from the shareholder side of the equation, are they in fact public domain information?

And as you might expect, there is a difference of opinion on those questions.

And to the extent that that could be made user friendly or aggregated, etcetera, clearly it would be of great assistance to those that want to enter the marketplace in a competitive environment.

You know, I'm told that we can literally pull out, for example, all the dry cleaners in West Los Angeles. That might be something that would be of great assistance in terms of aggregation. I'll leave it at that.

**MR. HANSON:** Yes, well we do not have it to my knowledge merely that capability in terms of our information systems.

This issue of just how much information will have to be shared and with whom we are still very much in the process of sorting out. And I would say the Wisconsin commission is probably about a year away from -- maybe less -- from working through this particular process in terms of our 32-step plan to get to retail



wheeling.

We are still very much absorbed in the ISO right at the moment, but I would think that that would be certainly critical information that if it has been ratepayer funded I could understand the arguments people would make that this ought to be made available to the marketplace. The marketplace, of course, one of the conditions of economic efficiency is perfect information. And if we are withholding some rather good information it's hard to get market efficiency.

**CHAIRMAN IMBRECHT:** Particularly if only some of the players have access to it.

**MR. HANSON:** That's called market power.

**CHAIRMAN IMBRECHT:** Thank you.

**MR. WEINBERG:** Let me ask you one. I am intrigued by the fact that you publish your budgetary information on the Web page.

**PRESIDING VICE CHAIR RAKOW:** Yes, I think that's --

**MR. WEINBERG:** Was that just an easy thing to do? Did it cause consternation? Nothing? You just decide to do it one day and that was it?

**MR. HANSON:** Well, there are two levels of budget information. You can get our formal audited accounts and our annual report. I think that you can probably give me a call and if you wanted to see our audit, I'd probably say that's fine too.

The information though that we have that we use from a management purpose is not our audited level information.

**MR. WEINBERG:** Okay.

**MR. HANSON:** It tracks our -- it's somewhat forward looking and it tracks our external dollars that we assigned to the projects. Not in -- does exclude largely our internal dollars.

So in other words, we have about out of 4.2 million you will see I suppose something like three million on these budget tracking sheets which is the dollars that are earmarked for external.

But, so it isn't, you know, it may be plus or minus a couple percent, but it gives you a pretty good sense in a very timely fashion. You are not waiting for your books to catch up with what's happening in your project. So that level of information is somewhat different and no one batted an eye at putting it out.

**PRESIDING VICE CHAIR RAKOW:** Does it track the specific budget for a specific project or your general.

**MR. HANSON:** No, it does every --

**PRESIDING VICE CHAIR RAKOW:** Project A and you can see exactly what phase the project is in and how much money has been spent --

**MR. HANSON:** Actually, you can see --

**PRESIDING VICE CHAIR RAKOW:** -- and how much to go?

**MR. HANSON:** Right. How much was contracted; how much was spent to date; how much is to go; did the actual contract, was it over or under expectation. And then we have a special column seven in the sheet, the tracking sheet, and that allows you to say, well, if it were underspent in that area that then frees up budgetary dollars for new things or projects that cost you more than what you guessed, you know, 18 months earlier when you were in the planning cycle.

**PRESIDING VICE CHAIR RAKOW:** Thank you.

**MR. WEINBERG:** Thank you, Mark.

**MR. HANSON:** The last item then is the question on our Web page.

It is <http://www.ecw.org> [sic].

**COMMISSIONER ROHY:** Thank you.

**MR. HANSON:** Thank you.

**MR. WEINBERG:** Thank you very much.

The last presenter this morning is Mr. Bill Marshall who is the Deputy Director of the National Renewable Energy Laboratory; and NREL, of course, is the premier laboratory in this country involved in the development of renewable energy in energy efficiency technologies and the transfer of these technologies to the private sector. It's been in business since 1977 and have what I consider to be probably the most interesting advisory board since it's called Congress.

Bill.

**CHAIRMAN IMBRECHT:** Not bad, Carl.

**MR. MARSHALL:** Thank you, Carl, and good afternoon,  
Commissioners.

I'll try to be brief, and perhaps I'll bring a slightly different perspective than what you've heard up to this point because I consider ourselves to be both an internal implementor of R&D programs as well as an organization that manages some R&D -- quite a bit of R&D outside.

As Carl mentioned, NREL began as the Solar Energy Research Institute in '77 and was renamed NREL to more properly reflect its broad base of interest in

1991.

We are a single purpose laboratory. We are in the applied energy business. We are related specifically to renewables and energy efficiency technologies and we have no interest nor any strategic goals to be outside of that. So we are very very focused. We support a broad range of technologies, ranging from photovoltaics, to wind, to biofuels, to the use of municipal waste, to solar thermal both in an electric and industrial heating situation, and the entire spectrum of renewable and energy efficiency technologies including building technologies at the laboratory.

We are currently a size of about 700 people with a budget of about \$185 million. A full 50-percent of that is placed outside the laboratory for cost shared R&D, and that turns into factors. I get all kinds of different reports, but factors of two or three or four in terms of what the industry is placing in the R&D in their own business. It fluctuates depending a little bit on the health of the particular industry that's involved.

I mentioned we have \$185 million budget. About half of that is placed outside. That budget represents projects which range in size from about \$50 million for a single project, notably photovoltaics, to projects as small as 100- to 150- to \$200,000. So we've got the entire spectrum of work that we do within the laboratory in that respect.

We have no specific commercial products within the laboratory. We are not in that business; and therefore, all of the technology that we develop and all of the R&D that we do brings us right up to the industry and the user. So we are

deeply involved with that as a measure of our success.

In fact, in the end, if a technology that we develop within a laboratory ourselves, and that we support through R&D contracts does not find its way into affecting the marketplace, we can never consider ourselves fully successful. And that's one of our measures that we have, and that's sort of a balanced scorecard to determine how the R&D that we're doing feeds into the applications across the industry.

Now, having said all of that and hoping to use that as definition of what NREL is and what it does, I'd like to make a couple of comments about how we set about and determine and manage our R&D program. Again, to remind you that it's 50 percent basically conducted internally either in R&D or supporting that R&D, and the other 50 percent is placed outside through generally competitive contracts across all of the technologies varying from one to one.

We use a set of principles in order to determine what we do. Basically we focus on energy and sustainable development. That's our business. We don't have any other business.

We focus the R&D more specifically on renewable and energy efficiency technologies. Again, we don't have any other business.

We build a strong bridge of partnerships with industry, university and other laboratories. We have some virtual laboratories that exist between ourselves and some of the other other sister laboratories within the Department of Energy that also do some energy R&D work.

And finally, we apply the science and technology that we involve

ourselves in directly to advancing renewable and energy efficiency technologies. We have all kinds of scientific curiosity, but we try to focus that curiosity toward meeting an objective and a goal with whatever we're undertaking. And that is how we, in fact, those are the principles that we use to set up our programs.

Now if you look across our programs from one that has a \$50 million annual budget, it has an annual operating plan. That would be something that might be 30 or 40 pages long that outlines all of the projects within that.

If you look at a project that has 100- to \$200,000 it might be a three-sheet work agreement with the Department of Energy who supplies the lion's share of our money through appropriations from Congress.

And so we have varying degrees of contractual relationships between ourselves and the Department of Energy ranging from annual operating plans to very large and complex projects to field work proposals, two or three page agreements that we execute with the Department for 200- or \$250,000 projects.

Within that, we will define what goals we are going to accomplish and we hold ourselves accountable and the Department evaluates us every six months. At the end of March and at the end of September they do a thorough evaluation of the laboratory with respect to the goals that we met and the goals that we do not meet.

In our M&O, our maintenance and operations contractor, the Midwest Research Institute, is a performance based fee operation of the laboratory and it's fees is determined by how well we meet our objectives, how well we meet our milestones. Not only in our research and development, but in the management of

the laboratory as well.

So we are very much performance based oriented. We are very much hooked to a set of objectives that we define and the Department agrees to. And to a large degree we define then the work within the organization with a wide variety of advisory boards.

I think I'll not spend too much time on that because you've heard from I think everybody here the absolutely essential nature of networking and defining the work that you do with the people that are in fact going to be involved. And it is crucial to us because again, we don't have a technical product. We have some intellectual property that we can use in different ways. And in many cases, we don't even hold the intellectual property. So it varies.

But it's absolutely essential then that the people who are going to be selling the wind machine or selling the biomass gasifier, that they are intimately involved in determining the R&D work that we do. And so they are. We have variety of panels and review boards that look over us ranging from the one that Carl mentioned of Congress through it GAO and other people of that nature to a group of, for instance, the photovoltaics industry.

We have an advisory board for our large program in photovoltaics which is basically university research professors to give us the continuing influence on how we want to manage the science and technology base of what we're doing, as well as the industry who are trying to sell a product in today's market and are looking for a continuing edge to drive their costs down to get to a bigger share of the marketplace. So we have that in all of our large programs that provide us that

advisory capability.

Now just in closing I want to talk a little bit about restructuring because I think it relates very importantly to the dynamics of the business.

In my view of the renewable and energy efficiency industry is a pretty fragile business. It is not dominated by huge dollar volumes. And most of them are pretty -- are working very hard to stay ahead.

We had to re-shape ourselves to be able to be more responsive to them. We have, for instance, in our procurement area, we now have a procurement staff that is 45 percent of what it was a year and a half ago and we've reduced the cycle time to it is now 60 percent of what it was a year ago. So those two factors have caused us to be able to respond much more clearly to the industry that has to have things going.

Some of those people need cash flow to do their R&D on a continuing basis, and we have to be responsive to that. And so we've gone about trying to do that.

We are also trying to reduce our internal costs, of course, in order to get a higher value per dollar research in our own organization.

We do an intense amount of collaborations. I sometimes am frightened to think of how many people are at the laboratory on any given day from outside the laboratory because it is a public interest R&D institution and there are just people on it all the time. Tremendous amount of collaborations.

We do a lot of cooperative research and development agreements called CRDAs with institutions and with businesses. We have had some that we



have placed a staff in the industrial organization for six months at their expense. They will write us a research agreement and provide us in order to transfer the technology into their marketplace.

And there are other cases. We've had a number of small spinoffs. I'm told something of the order of 30 to 35. I suspect probably ten of them have been successful, if we were to count. But we've had people taking the technology out to go to try to start small businesses. And we promote that.

We've had a lot of cooperative work and collaborative work with a lot of California companies and with the Commission as well on a number of different things, and we look forward to that. And if there is any way we can support you in implementing this program as you go forward in the R&D and you think that would be beneficial, I will simply offer the laboratory as a resource to you that you might want to take advantage of or at least to consider because we would like to consider that as long as you're talking about renewables and energy efficiency technologies. That's our business.

Quickly, lessons learned:

Involve your stakeholders early. People don't know about something they get very concerned about it.

Communicate often and early.

Make your choices. Someone mentioned earlier you'll never have enough money. We have \$185 million a year. That may sound like a lot of money, and it is. But we still don't have enough money to do everything that people bring forward. So you have to be able to make your choices and decisions based on your

well thought out goal and mission. You'll never have enough money. You need to be very strategic about it, about what you're trying to accomplish.

And I think in my thought to you would be to consider very carefully the balance of the short term/long term. There certainly is a press in the industry these days to shorten up its R&D for its own reasons. We all understand that. And so public interest R&D has an opportunity to at least balance short and long term research and development as you go.

Thank you very much.

**COMMISSIONER SHARPLESS:** You went over something rather quickly. I just wanted to have you repeat it.

Did you say that you went out to contract for some type of manager for performance?

**MR. MARSHALL:** We do -- I'm sorry. Let me back up a minute. The Midwest Resource Institute, a not-for-profit out of Kansas City operates NREL for the Department of Energy. The point I was trying to make is we are very performance based in how they get their fee for operating the laboratory.

So we set out a set of objectives that include research and development objectives and goals to be made. If we make those goals or exceed those goals, then the M&O contractor benefits from that.

But the point of all of that was how do we manage our R&D. We set out objectives. We set out goals. We set out milestones. And we even connect up the fee that the operator of the laboratory gets to us meeting those goals and doing our research.

**COMMISSIONER SHARPLESS:** Okay. So are they also involved in the putting together the stakeholder groups?

**MR. MARSHALL:** Yes.

**COMMISSIONER SHARPLESS:** Okay. And so they are the manager, but the infrastructure of the lab is involved in that entire process. It's not just handed off to the manager.

**MR. MARSHALL:** Not at all. Not at all. There is very much of an involvement, yes.

**COMMISSIONER SHARPLESS:** Okay. And there's one other thing I wanted to ask you.

You strongly emphasize the fact that your measure of success is how it finds its way into the market. You've got this 50 percent of \$185 million internal, 50 percent matched external.

**MR. MARSHALL:** Right.

**COMMISSIONER SHARPLESS:** Do you see a difference in the ability to make that goal from the which half the 50 percent? Are you more successful with the 50 percent that's farmed out? Are you more successful with the 50 percent that stays in-house? Or, is it hard to judge?

**MR. MARSHALL:** It is difficult to judge, and for good reason. It has a different focus.

Let me just take photovoltaics a minute. If you go and into the photovoltaics business, they are selling like 90 or 95-percent single crystal silicones cells, and they're selling, and that's their business. They are interested in improving

that product and getting the cost on down a bit.

A lot of our R&D is pointed at what happens when you eventually get around to thin film photovoltaics which is an entirely different technology. So our focus would be a little bit on the longer term internally, whereas the research that we work with them collaboratively is a little bit shorter term for them because they are again trying to get a more reliable product out. So it has a different focus about it.

**COMMISSIONER SHARPLESS:** But in way, the two are connected.

**MR. MARSHALL:** They are very much connected. They have different time lines. It's a smooth transition and you can see the evolution in the photovoltaics industry now. There are people beginning to build thin film plants to move from single crystal silicone to CIS or something like that. But it has a slightly different focus about it, and they are compatible and they support each other.

**COMMISSIONER SHARPLESS:** Thank you.

**CHAIRMAN IMBRECHT:** I just have one comment. I was imprecise in my earlier comments that were somewhat critical of DOE. NREL is specifically exempted from those criticisms.

[Laughter]

**CHAIRMAN IMBRECHT:** We have enjoyed a very good working relationship with you, and with a former Californian now as your director, and --

**MR. MARSHALL:** Actually, I --

**CHAIRMAN IMBRECHT:** I didn't want to disarm you so much.

**MR. MARSHALL:** Actually, I thought you were just trying to set me

up just to see what I would do.

**CHAIRMAN IMBRECHT:** Thank you.

**MR. WEINBERG:** Let me check with you, Commissioner Rakow.

What time would you like to end this up? I want to get a little discussion going, but we're getting short on time. Do you want to focus on a particular time frame, and I'll focus the discussion, make sure we get there.

**PRESIDING VICE CHAIR RAKOW:** A discussion now, or when we reconvene?

**MR. WEINBERG:** Well, I can finish with this panel, yeah. If there's any other discussion that you have, maybe like 10 minutes.

**PRESIDING VICE CHAIR RAKOW:** All right. How about 10 minutes of discussion? We were thinking of coming back at 1:45. Then we could have the discussion at that point.

**MR. WEINBERG:** Yeah, we can take about 10 minutes. Well, we'll see how it goes, okay.

**PRESIDING VICE CHAIR RAKOW:** All right. Fine.

**MR. WEINBERG:** Great. Of course I have a question to start it off, and I will just ask each of the panelists to kind of comment on this.

And all of you have remarked the need for advisory groups or review groups or technical groups and so on, and there's a number of ways of running groups. And there clearly is a consensus approach versus a kind of majority vote approach. And people have likened the consensus approach as the tyranny of the minority, and the vote approach as being the tyranny of the majority.

Have you struggled with these questions in your advisory groups, and let me start with Mark, and we'll just go down the panel.

**MR. HANSON:** In our experience what we attempt to do at really, I guess, implicitly at the board and explicitly with our two key advisory committees and our sector standing working committees is we try to achieve a loose consensus on whether we ought to do a project or approve a contractor, or, you know, whatever that committee is working on.

A loose consensus being that no one of the stakeholders, and I've already described our stakeholders so it's a diverse group, no one is so unhappy about the proposed action that they want to object. You know, they may be unhappy, but they're not so unhappy.

So we always try to get there, but when we don't, we take a vote. And I would say that over 90 percent of the time the loose consensus works, and when it doesn't, then we say, all right, we've gone far enough, time to take the vote. And we take the vote.

**CHAIRMAN IMBRECHT:** An act of governing finding that greater shade of gray between opposing views of black and white.

**MR. MARSHALL:** Well, I would agree with that to a large degree. But the point I was trying to make when I said you need to formulate your activities based on what you have to accomplish, and what your strategic plan is then comes into play. Because there may be occasions when particularly if, in fact, people feel like because of the decisions that are being made that money may not be available for a particular area of work. But if it's not strategically important to you, you still

may have to ultimately do that.

So always try to build consensus and get people involved, but to help them understand where it is that you're trying to go with the whole program.

**MS. JOSEPH:** I would say from NYSERDA's perspective our advisors are advisors. They provide their perspective, their view, we try to get consensus; but ultimately the decision as to whether we advance a project, fund a project, start a program, will be made internally.

The far majority of our projects and programs are approved by all of the members of the Advisory Committee or Technical Review Committee. But there is no doubt in this world there is a difference of opinion. And if you always seek to get consensus, you could get stagnated.

**MR. WEINBERG:** Janet, let me ask you one of your things that you showed is that your plan is sort of approved by the Governor?

**MS. JOSEPH:** The Governor approves the major actions of our board. Basically that means he signs off on our plan and our budget. In the six years that I've been with NYSERDA the level of approval is typically, okay, the board signed off on it, that looks good. So it's certainly we are not micro managed by the Governor nor are we micro managed by our Legislature.

**MR. COURTRIGHT:** We tend to focus I think more towards the consensus approach. We do get in some situations on allegation of dollars where we'll get to a voting approach.

Just from experience one thing I'd like to put out on the consensus approach is that if you use consensus, you don't want to make sure it drops you to

what I would call the lowest common denominator, which I think Janet alluded to, too, which devalues the project, and it actually becomes bad research in my opinion because you've sometimes have gotten to be so low on that totem pole it's not really the value pushing the envelope considerations. So that's the only caution I would put towards that.

**MR. COLE:** We strive for consensus. If there's a particular issue or conflict, we try to understand what the basis of the perspective is because it may inform the research or development scope of the project. And if there's conflict, it usually rises to the next level of the Planning Committee if it's in the context of the funding of the project. And if there's conflict there that we can't resolve, we certainly take it to the board which can make the final decision.

**MR. WEINBERG:** Betsy, you don't want to comment on that since you don't know how your boss goes on this or what?

[Laughter]

**MS. KRIEG:** I don't want to comment on it because CURC doesn't have a research program.

**MR. WEINBERG:** Thank you, Betsy.

**CHAIRMAN IMBRECHT:** Mike, did you have a question?

**MR. DeANGELIS:** Yes, I've got a question for the panel. First I would like, I think Betsy, to address it because she did address this somewhat at the Commission's En Banc Hearing of October 16 as it related to RD&D.

But my question has to do with the actual development of an RD&D public interest RD&D plan itself. And clearly there can be a tremendous amount of



detailed work that goes into producing a plan, or it can be done at a more simple level.

And what I'd like you all to address is what are the key components that has to be included in that plan if California's going to develop a California multi-year public interest RD&D plan? Betsy.

**MS. KRIEG:** I think you're alluding to my comments of the en banc, but you ought to focus on developing a, not a detailed program plan, but a general guideline of what you want to do. And I would say that the comments you heard today are consistent with that. You need to develop some clear objectives within some focus groups.

I think at a minimum you need to decide what you're going to focus your program on. Whether it's energy efficiency, renewables and environmental aspects of generation or something else. But be very clear on what you're focusing on. And then within that set up some standards on how you're going to develop project by project objectives.

I don't think you want to try to define a four-year program plan and say these are the five areas we're going to work on. Here are the 32 projects that we're going to do, and here's how much money we're going to spend on them.

You want much more of a blueprint. Here are the areas we're going to focus on, here's the criteria we're going to use to make decisions in terms of which projects we'll go forward with and make explicit decisions on how you're going to value the success of the project during the course of the project and at the end.

And if you've done that in conjunction with an advisory group, I think

you're going to end up with a very robust public interest RD&D program.

**MR. WEINBERG:** Jim, you have a comment on that?

**MR. COLE:** I think I pretty much agree with Betsy in all areas. I guess the question of criteria, I think, are important. Both in terms of a checklist set of criteria, the project or program might vary by program or whatever, and then a valuate of criteria.

Presumably, the energy efficiency or renewable energy production benefits of the technology when broadly applied, I think, ought to be one of the key criteria in selection of projects and programs.

You may have to initially, the board may have to make some decisions fundamentally about how much of the resources should go into renewables, energy efficiency or whatever. It may be difficult to compare those two, so the board may have to make some policy judgments. And then within the policy judgments how to compare projects with some kind of quantitative and qualitative criteria.

**MR. COURTRIGHT:** I think I would go back to my original comments. I may be a little bit more specific than the other two commentators, that I think you need for each project a plain deliverable and a time frame for that deliverable.

I think our experience has found that if you say you're doing research in an area, that can be essentially too loose to best manage your funds and the resources that you're putting into it.

That deliverable can be modified and changed over time. It has to be flexible and dynamic, but I do think you need to say out of this piece of work we

expect this result at this time. And continually manage that. If you don't do that, I think you'll find time slipping away and your results not being at the caliber that you're looking for.

**MS. JOSEPH:** I think there are two levels of planning that we need to consider.

**MR. WEINBERG:** Get closer to the mike, please, Janet.

**MS. JOSEPH:** Oh, okay. The first one is more of a higher level program planning. At NYSERDA our program plan, I have copies of it here, it's really a blueprint. It lays out objectives and goals.

And the main objective of our program plan is not to provide a detailed technology roadmap, but to get input from potential stakeholders.

Now at the project level, it's a whole other level of detail. I agree that at the project level you need specific targets and metrics whereby you can evaluate the performance. But we kind of need to keep those separate.

There is program level planning and then project level planning and implementation. They're related, but they're, you know, very different beasts in terms of detail.

**MR. WEINBERG:** Bill? No? Okay.

Mark, I notice you broadening into areas that, like market research for instance, that in general, I would guess, would not be considered public interest R&D. So it would be interesting knowing how you managed to move into that.

**MR. HANSON:** Well, I guess a couple comments that we, on an annual basis, do our planning. It begins about 10 months before fiscal year begins.

And within about five or six months before that you pretty much know what the plan is going to be that the board is going to be approving and work with.

Right now our only criteria is: Does it fit our mission. And there's a subset of objectives I won't go into. But does it fit.

There is an informal, there has been the last two years and kind of an unwritten guideline, that it's about 25 percent industrial, 25 percent commercial, 25 percent residential and 25 percent of the effort is workshops, public information training type things.

And among the commercial and industrial, and some ag I would add, and residential, it's about 50 percent research and 50 percent demonstration is the way it's been working out. And I think it's something that we somewhat look for but don't feel compelled to follow.

So it's a rather short, in essence it's a rather short-term time line we're taking. Some of these projects may take two or three years to execute, but you're asking 18 months ahead, I should say eight to 10 months ahead of when you're going to start, do we want to go initiate this new thing, or do we want to continue one of these things is existing and we thought we were going to continue let's verify.

And I would, and within that context is where some of this market research public information training items come up. Because when our members ask for it and good ideas are developed and they can consense on it or close to consense, we say, okay, we will do it.

The last thing I would add just to modify my previous comments is while we do look for consensus and take votes, ultimately these are advisory, I

think as is the case at NYSERDA. These are advisory, and the executive director finally makes a decision. And if you think you've gotten bad advice, you can say that and take the heat.

**CHAIRMAN IMBRECHT:** Maybe we can conclude on that. I just would say that, I mean, fundamentally as long as you have public institutions who are responsible to elected officials, etcetera, fundamental delegation of the ultimate decision is essentially incompatible with government, as I understand it. And like it or not, the five of us have been given the responsibility to make that decision.

That doesn't mean we don't weigh very heavily the comments of our advisory groups. We have many, as has been indicated, within our existing organizations.

**PRESIDING VICE CHAIR RAKOW:** Carl, do you have other comments?

**MR. WEINBERG:** No, I don't have any. Do you have any other questions? Mike?

**MR. BATHAM:** Several of the panelists have indicated that it's important to have a diverse group of stakeholders that are frequently involved with the planning and the review process. My question is how do you get that group of diverse stakeholders, especially those that don't have a financial interest in the program that's being conducted by your various organizations?

**MR. WEINBERG:** Janet, do you want to go ahead?

**MS. JOSEPH:** One of the things, it's basic outreach. And it does take years, in many cases, to build these networks. One of the things that we have found

to be effective in New York State is to work with existing organizations of technology development organizations. These are functions associated with our Department of Economic Development. We have business councils, these so-called TDOs, Technology Development Organizations, and various types of industry association in the state. Those have been effective outreach vehicles.

But it is really a significant time investment in building these relationships. I don't think there's any silver bullet answer as to how to get those stakeholders to the table. But we try to use existing organizations as much as possible in terms of councils and so-called TDOs in New York State.

**MR. MARSHALL:** Likewise, I guess the one thing that we would do differently is using non-DOE funds. We could, in some cases, hire somebody as a consultant or for a day or two or something to be a part of that if we believe they bring a perspective that would make it worth our time. So we've done that from time to time.

**MR. WEINBERG:** Mark.

**MR. HANSON:** Well, I guess an observation that I would have that in terms of our stakeholder groups at the table, they are all part of governance. And they've got a, as they come in, they, if you are, for instance, a public interest group member that may not be on our board, you certainly are in touch with a public interest group member that is on the board, and, therefore, they have a, whether or not they are contributing resources to it, it is affecting their interests.

And as being as that they are formally part of the advisory structure, defining structure, oversight structure, they come to the table with a real stake in

what happens. And given that reality, they are there at the table. They are very consistently there at the table. So in terms of our immediate groups at the center, they've got a stake in governance.

**PRESIDING VICE CHAIR RAKOW:** I have a question on the advisory aspect of it. Do you find that you have to build in some flexibility and definite sort of time limits in the advisory groups so that they are not there forever and ever and their feet are cast in cement, and they, you know, build up their own bureaucracy?

**MR. COURTRIGHT:** We tend to use a three-year cycle and try to stagger people that you have at least some consistency of core membership on the group. But most of the advisory groups we use is a three-year basis.

We find people aren't willing to commit much beyond that, not knowing what their future might be. And I think, also, it tends to provide us a nice changeover on a one-third of the organization every year, which is good.

**MR. WEINBERG:** Any comments? Jim, you have a comment on this?

**MR. COLE:** On an individual project basis we usually try to structure two meetings a year. One in the early stage of the project to sort of help guide it in the right direction, hear where the phase is going and what they're trying to achieve. And hopefully the advisors will provide some assistance to people doing the project.

And then at about the three-quarters of the way through the project, when you're beginning to make decisions about did you accomplish the objectives, is it worth continuing the project, what should the scope of the next phase be.

So we try to limit it that way to structure it and provide targeted input.

**MR. WEINBERG:** Okay. Well, I want to thank the panel very much for a very constructive input. I hope the Commissioners got something out of that. I think it was an excellent panel, and I appreciate all of you sticking pretty closely to the time lines, getting us time for lunch.

**PRESIDING VICE CHAIR RAKOW:** We'll scurry for lunch and reconvene at 1:45.

[Luncheon recess taken from 12:45 to 1:50 p.m.]

**PRESIDING VICE CHAIR RAKOW:** All present and accounted for. There's the last. We will then begin the afternoon session with Panel 2.

Carl.

**MR. WEINBERG:** All right. Now Panel 2, I mentioned this morning that Panel 1 kind of focused on doing the right thing, and I think this panel's focused on doing things right. So part of it has to do with --

**CHAIRMAN IMBRECHT:** I thought you were going to say the wrong thing.

**MR. WEINBERG:** No, no, no. That comes later.

**CHAIRMAN IMBRECHT:** Okay.

**MR. WEINBERG:** But we have a number, it's a fairly big panel, and the time frame is going to be kind of tough. So I'm going to really hold people to the 10 minutes to get our way through this.

And the only other admonition I would make to people is that I hope we're not into a product endorsement panel here. Because the idea is the



interaction R&D community, not necessarily the selling of your particular product. And we can point out the things that are helpful to you and what may happen to you.

And I'm happy to see Don Aitken here who may be one of the few people that's not selling a technology necessarily but selling ideas from a public interest viewpoint.

So I'm just quickly going to read people's names, and raise your hand as I mention it. We know who you are.

Richard Brent. Okay. Bob Kendall, Hank Leibowitz, Dan Shugar, Larry Papay, Barry Butler, Mark Modera, and Don Aitken.

That's so those of you only see the backs know who they are.

We're going to start off with Richard Brent who is the Manager of Commercialization for the Advanced Turbine System Program at Solar Turbines. And they're a manufacturer located in San Diego in industrial gas turbines that go from one to 25 megawatts. He's assigned to the engineering organization to support the demonstration and commercialization of advanced technologies. So it clearly is an interacting in this way with the research community.

Richard.

**MR. BRENT:** Thank you, Carl, and thank you, Commissioners, for the opportunity to speak to the panel today.

We took pretty serious the brevity of time, 10 minutes, to try and explain what we do to outline our approaches in meeting R&D in our particular organization and how we marry that research and development demonstration.

And I'm going to add the word "commercialization" to that, when we look at public interest programs as well. So I'm going to try to go through the three questions that we were outlined to address and then leave that open for any questions should any come up.

What's important, as well we're here not to sell product, we're here to understand that it is the successful sales of the product that in turn gives us the profits to reinvest in research and development. Companies like ourselves spend a significant amount of money on a year-in/year-out basis on developing incremental technologies to improve our products in order to meet the requirements of the marketplace.

And so I would say key to the understanding of our R&D efforts and the efforts where we collaborate in public interest is where the customers' interests are met through an understanding of market research, and then the private interests are met through cooperation with organizations like the California Energy Commission, Gas Research Institute, EPRI and, in fact, the Department of Energy.

The Advanced Turbine Systems program is a program just like that. And I think the key point to my first comment here on describing the goals is that we are market driven. We need to understand what it is that the customer is looking for. Not only the customer's buying criteria, but the customer's motives in those buying criterias, and just as importantly what are the customer's habits in making those buying decisions.

Once we do that, then we sit down in a panel, usually through what we call a turbine product strategy team made up of marketing and engineering and

customer services organizations to look at products and services that we can bring through a research organization and program that will improve the product that we're taking back out into the marketplace.

Once that's done we take that up into the steps of the governing board, which in our case is the Products Committee, ultimately the president and his staff, and then the decision is made to go forward or not go forward with the product.

Key again, and I can't over emphasize this enough, the concept of market research. This morning's panel talked about market research, talked about commercialization, and, in fact, some of the folks talked about understanding the needs of the customers, but didn't quite jump on the word of market research. And I would again contend as private industry that becomes critical to us in the R&D efforts that we do.

We tend to invest in applied research. We do the same thing as Betsy talked about earlier today. Where our research group within engineering will scan for available technologies and then use the technologies that are available and apply them into the product so that we can take those applied research, once proven through demonstration, and insert them within our product lines.

We try to look at the public interest R&D programs that we invest in as a marriage between the corporate goals that we've got and the beneficial goals that come to society as a result of the public interest R&D dollars that are being expended.

For example, for us combustion technologies that either done through dry low NOx or catalytic combustion, it allows us to be able to reduce the emissions of our product into the marketplace where it is served.

Improvement in efficiencies, lowering the cost of the product, all things that the customer is looking for, and at the same time we're looking for as well.

At the same time I would also suggest that in private industry we need to be flexible. Earlier today we heard comments about 18-month windows, or three-year windows or longer, to look at how do you make the decision on what to invest in R&D today and how will that decision be affected by the externalities that may come into play as you're in the process of that particular project.

So I would kind of jump forward and suggest that in the administrative criteria that you all look at is the understanding of some flexibility with the contractor who is trying to be sensitive to the marketplace in developing products that will have far reaching implications and will be commercially viable in that marketplace.

We do very little proof of concept work. We do a little bit more demonstration of those proof of concepts, but our aim consistently is the commercial marketplace and our ability to be able to take product to that commercial marketplace.

You were asked, or we were asked I should say, what were the vital elements necessary in a public interest R&D project to balance the needs of the organizations of our type and the needs of the public sector who's putting the funds forth.

I would say that a couple of the elements are talent. You need good people. You need resources. We have fine institutions here in the State of

California. We have fine research entities like EPRI here in the State of California and others.

And we need to be able to have a better marriage, a better understanding of how private sector and public sector can be working together in almost an alliance, if you will, strategic maybe, to take products that marry the best of both public interests, i.e., accruing benefits to the California citizens, and the private interest, if you will, or that is giving a fair return to the shareholders. Bringing those entities together takes talented people to do that.

Two, I would suggest, and it was mentioned earlier today, cooperative research and development programs where both parties have something at stake.

The investment's got to be made by all the people involved as opposed to by one entity handing dollars out. In a competitive environment, albeit, to that shop in order to be able to do that work. It's got to be a cooperative program.

We believe that the market is a sensitive and volatile market, especially with restructuring today, and trying to anticipate the needs of the market will be critical. Having programs like environmental benefits and having projects like lower emission combustion are critical towards meeting those long-term goals of the projects.

So I would contend that while you have the open framework of programs that you're involved with, you've got to be more specific on our projects, because dollars become finite. And in order to be able to know how you're going to expend those dollars, we can't just carry the umbrella of what are the public services that we want to provide, but, in fact, how can we take those in measured steps with

metrics and with deliverables back into the marketplace in a reasonable time frame.

And last I would say that the products that we have to put out into the marketplace has to have economic benefit. Economic benefits of the end user who will use the product, economic benefit to the organization who makes the investment, i.e., either in the public sector through the shareholders or even through the public sector, if you will, in giving, as you all suggested earlier, to accrue benefits of the California citizens through export opportunities as well as being used within the State of California.

Solar Turbines is not a company that takes a lot of public good R&D dollars and expends them. I did a little research and found out that the last time we as a corporation took a funding to develop a, in our case, a new gas turbine prior to the Advanced Turbine Systems Program of 1994 was 1960 with US Navy.

We've done a lot of different projects under public funding to support in cooperative agreements the kind of things that we were interested in, but we're generally not a company that takes a lot of those kinds of dollars and then tries to make good on proof of concept and then puts it on the shelf.

I'm very sensitive, in fact, Chairman Imbrecht, to your comments that it should not only be DOE that carried some of that moniker, but all of us may have carried at one point of time the moniker of developing research for the sake of developing the research.

We broke that mold about, I'm going to say about eight years ago at Solar, and our research today is more applied research, research that will give us benefit in either lowering the cost of the product, improving the durability of the

product, or now in the public interests improving the emissions signature, or, in fact, improving the efficiency level of that particular product.

The lessons learned in working with this particular kind of structure of public/private partnership I would think again would be the word “flexibility.” We found that as the market was changing and we were changing some of the nuances of our conceptual designs in the early days of the Advanced Turbine Systems Program that our government contractor had a difficult time understanding our reasons for change.

And we kept telling him it was the marketplace. It was the economics of the product. That while it was a good technology, it didn’t necessarily mean it would be bought and could be commercially viable in the broadest sense of the marketplaces that we serve.

And it took us a long time to get to know each other between, in this case, the Department of Energy and Solar Turbines as we looked at how do we have that kind of flexibility when you set up an objective with metrics and deliverables at specific points in time and find that they needed to be tailored and amended as the marketplace evolved.

The other point that I would make, too, is that because the market is shifting and because corporations like Solar Turbines tend to be intrapreneurial internally, entrepreneurial, if you will, we find that it’s hard to wrestle down the folks who are looking at public interest R&D dollars to be spent and making sure that it meets the marketplace through the commercial products that we develop.

I guess I would close by suggesting that, if I turn to one more point

here, that developing public good R&D dollars for use by contractors like Solar is an important thing to do, but at the same time it's got to be measured up against what it is that the contractor is looking to do in order to take that product to market.

And again the most comfortable analogy that I can make is the customer's concern for durability and cost, the public concern for emissions and efficiency, and the marriage of those two is really what I think starts to make the kind of public/private partnership to spend R&D dollars together.

Thank you.

**MR. WEINBERG:** Questions from the Commissioners?

**COMMISSIONER SHARPLESS:** Actually I guess I could throw these out, and they could be handled in the panel; but the two that come to mind was, one, market research comments and how Mr. Brent sees this working in a public agency, and whether advisory groups could serve partially to meet that market research goal.

And the second one whether the government role in getting over the wall that we heard this morning can be met partially by what I've heard strongly in your comments the need for flexibility and how we deal with contracting procedures on a government level and the concept of flexibility.

They don't always go together, and I think it's one of the things that we're going to find might be something that we need to focus on. So whether now or in the panel, I don't care.

**MR. WEINBERG:** Very quick answer now, and I'll save it for later on in the panel for the rest of them.



**MR. BRENT:** For us, technical customer round tables become our advisory group. We're constantly pulsing our customers as to: Is this something that they're looking forward to? Will they pay a difference for an improved technology?

So our advisory group tends to be our customers. But we look for diversity of the customers because of the diversity of the products that we offer into the marketplace.

I would also suggest that we've tried very hard to break down the silos or the walls, if you will, in our organization so that when we sit down together and discuss what is the product, what is the research and development that will take, you know, place in the next couple of years to ultimately find its way into our product, we do that with all aspects of the company sitting in review of those decisions. Ultimately to the point where all the vice presidents representing the entire breadth of our organization make that decision as to whether it should go forward or not.

The work is done at a lower level. But we've got to be able to jump over the wall, and, in fact, stand the test of, for example, when we develop a product. And we're worried about first costs. We find that the customer services organization gets concerned about what's the lifecycle cost. What have you done to my customer down the road to make that more expensive to maintain or you may have been able to take it out to the marketplace at a rather inexpensive price.

So I would say those are two quick thoughts on that.

**CHAIRMAN IMBRECHT:** I'll just offer in a more of a statement that

others might want to comment upon as well.

But it seems to me that durability and efficiency in a large sense are fundamentally subsets of cost. If you've got to repair more frequently or if you can improve your fuel to output ratio, etcetera, you're, you know, fundamentally lowering the overall cost on lifecycle basis for the purchaser. Largely driven, I would think, by good marketing and good market research and those sorts of things.

As I look at public goods it seems to me that to the extent that we can target investments, whether it's in combustion or in any of the other fields we've talked about, that leap frog of technology in a significant fashion above what becomes, in essence, the, when we talk about the creation of WEPEX in the restructured market and a market clearing price, I would suggest that there is, in essence, a durability clearing level and an efficiency clearing level they become, in essence, de facto industry-wide standards until somebody has a breakthrough and moves that significant step ahead that gives them a competitive advantage.

On the emission side my experience has been that most simply try to meet the standards that are in place. And again to the extent that we can invest in things that move significantly beyond the standards and allow potential displacement elsewhere in the economy from an air quality standpoint, that those might be reasonable criteria in terms of parceling out what everyone concedes is not -- it's a healthy sum of money, but not sufficient to meet all the research demands or interests of the private sector and public sector.

**MR. BRENT:** Thought comes to mind, Chairman, that we have many customers who don't want dry low NOx emission. We have many customers that

are very happy with 60 parts or 200 parts or greater parts per million NOx emissions from our product. They're not here in the United States.

When we take public good R&D, we've got to make a decision whether this is something that goes widespread across our product or is tailored made to meet a specific requirement or whether we even want to take that money because it's taking it away from someone else who might establish a particular technology that would have applicability in the marketplace that they serve.

So sometimes we're in a difficult position that by virtue of the regulatory entities who make a decision on what, say, air emission should be, we've got to go out and make a decision is that the thing that our customer wants to do just because we're driven by regulation to do that.

And so what we have to do is bring durability and lower costs in to improve technologies to reduce emissions. And it's not always cut and dry. Because in our business so much of it is material. How far can I take metallics before they are stressed out in the particular engine or the turbine that we're using. The same thing with efficiency. As I improve the efficiency, I'm also putting my product into a pretty harsh environment.

How do I marry durability and efficiency so that I can provide the public good, less fuel in, same work out, and at the same time be able to meet that durability where the customer says, I don't even want to talk to you about purchasing it until I've seen it run 8,000 hours, and I know that Joe over there has run one 30,000 hours.

So there's a real dycotomy between nice to have public good

technologies inserted and the requirements of the customers to accept those goods and still be able to be cost effective in their business. Because that's why they buy our product, for the economics, or the savings I should say, that would be put part to them.

**CHAIRMAN IMBRECHT:** Perhaps I should have provided another caveat, and that is that an efficiency improvement or an emissions improvement that still keeps the price within a marketable level.

**MR. BRENT:** It's a fine balance there.

**CHAIRMAN IMBRECHT:** Yes. I guess that's an easy balance.

**MR. WEINBERG:** Yeah, that reminds me of a discussion I was involved in in terms of businesses and customers where someone stated and said that if you don't give the customer what he wants, you're certainly not going to be successful. If you do give the customer what he wants, you probably will be successful. But if you give the customer something that amazes him, you will really be a huge success.

And I think leap frogging has this ability of doing something that amazes the customer, so it would be interesting to see how we do with that.

The next discussion is from Bob Kendall who is the President of Alzeta Corporation. And Alzeta is a small privately held company dedicated to commercially introduced advanced combustion technology to meet the needs of residential, commercial and industrial customers.

Bob.

**MR. KENDALL:** Thank you. I appreciate this opportunity.

I fit sort of as a supplier potentially to an organizationi like Solar and other organizations that use combustion technology. And as such they often are our customers, and so this creates a bit of a different view on the world.

Let me give a little background on Alzeta. We came into being in 1982. We're entrepreneurial organization with a commitment to creating product as was stated there. We started with certain assets which were mostly between the ears at that point. We had some good science, some good engineering; we had customers with some potential interests; and we didn't have much capitalization at that point. And so far we have survived without adding additional capitalization which makes us a success in terms of entrepreneurial companies who've survived 14 years.

So much for the plug.

We started off at that point with support from Southern California Gas and the Gas Research Institute. We've maintained approximately a constant level of outside funding support for R&D activities.

The customers from whom we've gotten that R&D have changed. At this point we're primarily from the California Energy Commission, Department of Energy, SYMETEC, and not so much from GRI and not so much from SoCal Gas anymore. Department of Energy is also a supplier of some funding to Alzeta.

But whereas in the first year of operation we were 100 percent supported by that sort of activity, at this point approximately 70 percent of our business comes from sales of commercial product. This was the goal of our operation, and, again, an indication of some level of success in what we have done and in the products that we have developed.

The products range at this point from burners that are in deep fat fryers at Kentucky Fried Chicken to approximately two billion BTUs per hour of capacity that backs up the solar power plants down in the Mohave Desert. So when the sun sets in the Mohave Desert, we start using a lot of gas. Unfortunately, it's from a Las Vegas utility rather than a California utility that feeds into the Barstow area, but that two billion BTUs an hour is producing 160 megawatts for Southern California Edison.

And that's being done reliably with a product that perhaps came into being because of the California Energy Commission's requirement that they have less than 30 parts per million of nitric oxide emission and a very high efficiency hot oil heater.

I'm sure there's a lot of interesting discussion we can have on the Luz Project at this point. Very exciting period in my life.

That's the range of activities. And that is what Alzeta and that is sort of my response to the first question.

The second question had to do with the lessons Alzeta has learned performing RD&D programs and some elements of success in those programs.

And in this regard I'd like to use a couple of analogies. One is the mercenary and one is the scout. I've always wanted to give a talk on the role of the mercenary in R&D. I think the mercenary has some interesting aspects.

George Washington, when he hired mercenaries to fight the Revolutionary War, obviously was wanting to win a war. And he had a particular goal, and I'm sure he would have like to have hired mercenaries that had a similar

view to the world as he did. He'd like a mercenary who wanted to win the war, win the peace, settle down, bring his family over here, start a big farm, raise lots of crops and sell them back over to Europe.

On the other hand, he wouldn't have liked a mercenary whose sole goal was to incite another war so he could get another job. And we do have that in the R&D community. Unfortunately those who simply like to say on conclusion to one project they would like to do another project.

The goal there, therefore, is if you're going to be a manager of R&D programs, you must have a similar view as to what you want to see as a reward to those whom you hire in that regard.

The other thing I mentioned was the scout, and there I haven't really thought through the analogies very well. But frequently the scout goes in, does find an area, identifies, other people come in and derive the benefits from that.

This is sort of what an Alzeta, small company like ours, can do. We frequently have gone in, demonstrated that something works. In Southern California we were one of the first suppliers of low NOx boilers, burners, to fire two boilers. In that role we demonstrated that it could be done, but soon other organizations who had greater resources in terms of marketing, service, installed manufacturing base and pretty much took that market away from us.

The boilers that we have supplied are still in operation and running well, but we couldn't match. But if we hadn't gone in first, how soon would those other people have come.

So I say there is a role for an organization like ours, and there are many

like ours out there I hope that go in first as the scout does. Hopefully the scout may find a claim or a homestead where he himself can have some benefit. And later on I'll get into that area of reward that must come to the organization that goes first.

So that leads on to some other thoughts. When it gets down to the real issues, there are three things that I'd like to emphasize in this whole area. One is knowing the technology. And that time is a key factor.

There's the old story that it took 50 years for the diesel electric to replace the steam locomotive. We're dealing in an industry that moves very slowly. Decades usually. We're talking in some cases about very large amounts of capital involved not only in the product but in the tooling to create the product. This slows things down.

We are also talking in terms of risks that's associated with a new product. And this is something that scares a lot of people.

There are other aspects of the introduction of new products. The commodity aspect. And what we find is most of the large, say, appliance manufacturers out there have a very strong commodity attitude. Well, they're large suppliers. They were successful with a commodity attitude. Who am I to say that a commodity attitude is wrong if the successful companies have that attitude? This is something we have to challenge in terms of getting new product into the field that serves the public interests.

So basically when we're talking the public interest, we're talking in low emissions, we're talking in higher efficiency, and one aspect of it that comes about through regulation is the issue of retaining business in California.



Some of the utilities in Southern California have adopted customer retention programs. Where an electric utility will fund a gas application, as Edison did in one case, because they wanted to retain that customer and their electric utilization. This is a public interest to the State of California.

Another is reward as another aspect in addition to the time that I mentioned. And in the reward area, I think I've already touched on that, is that frequently the reward is not going to come to the scout who goes first. It's going to come to those who follow. And the scout has little control over that.

So when the funding agency is looking for a reward in terms of royalties, that agency will frequently fail. I think there was a comment here where somebody mentioned dollars spent and royalty revenues in, I think it came out one percent of the investment.

This is to be expected when you're doing public interest R&D. That the company you fund will not necessarily be the one who realizes the big rewards.

Should you then fund the organization that comes in, say the ones that came in behind us in Southern California, to meet a particular rule and fire two boilers. I would disagree with that approach in that they don't necessarily have the same motivation that we do. We look for a niche that ultimately we can fill later on in the game and perhaps get our reward in that regard.

Finally I'd like to touch on trust. I think the issue of trust between the funding agency and the performing organization is critical. The lawyers get involved in this, and lawyers have a duty to perform which is often an adversarial role or an advocacy role. As we jokingly say sometimes the lawyers are always

planning for divorce and that's their job. We need to plan for a long and happy wedding, and that is built on trust. And that's why I say we have to focus on trust.

There was an example that I've used before where we had a funding program from the California Energy Commission, Southern California Gas, South Coast Air Quality Management District, and this also involved UC Irvine Medical Center, who was going to buy a boiler from Zerme Industries to be installed by M.C. Patton Company with a burner from Alzeta using an Alzeta design boiler.

All these organizations were involved. We had a phenomenal success. That little piece of glass over there is from the South Coast Air Quality Management District recognizing that this was a clean air success for Southern California.

In that particular operation we never had anything but bilateral agreements. I'm opposed to multilateral agreements because they don't often happen very quickly. We never had a lawyer from one organization talk to a lawyer from another organization. Zerme guaranteed to the hospital that they would meet a NOx requirement. We had guaranteed to Zerme that our burner and our design would meet that requirement.

The project managers from the Energy Commission and SoCal Gas took active involvement, even to some arm bending at the hospital administrator level in terms of getting that project to move ahead. South Coast AQMD was sort of passive in the whole operation, although they funded some testing work on the system.

I've always used that as an example. There were a lot of hurdles that came up in that project. Were it not for the trust basis we had, that would not have

succeeded.

Let me just conclude with about six points that I think summarize my thoughts. That in order for things to go successfully you need to know the energy industries in your focus. There has to be knowledge in this organization of what industries you're attacking. You have to know the goals and rewards that you're expecting.

You need to choose contractors whose goals are similar to yours. You need to work closely with your contractors and their partners to build trust. Don't impose delays and constraints without very good reason. And let your contractors win for you and for themselves.

And I'll have to quote one thing from the good old book that says, "Do not muzzle an ox while it is treading out the grain." Deuteronomy 25:4.

And with that I will conclude with and you got to have good people to make this all work.

**MR. WEINBERG:** Thank you, Bob.

Any questions from the Commissioners?

**CHAIRMAN IMBRECHT:** Just real quick comments. Trust issue, we have endeavored to develop that with all of the people that we've had research contracts with. It is a reciprocal character of dealings. If there's going to be trust, it has to flow both directions.

And I'm delighted to hear that we didn't have to involve lawyers. We have found, even though I happen to be one, I'll say that we have found that if we have a cooperative partner, an applicant, and we ordinarily do not have to involve

the legal profession.

Unfortunately we also have some people that want to literally slice everything around the edge to the point that it becomes necessary to ensure that we can, in fact, protect public investments with adequate collateral and those kinds of considerations. And it's just something that I think it's important to remember.

Our effort on, and obviously you've heard these themes emanate from this place for some time, but our efforts to focus on efficiency and emissions have been designed, frankly, to enhance or maintain at a minimum the economic competitiveness of California.

Obviously we also are quoted a lot of times nobody pays utility rates; they pay utility bills. There's two ways to attack the bill. Level of consumption or trying to lower the rates. And since the rates are not within our jurisdiction, we have focused very heavily on efficiency, whether it's end use sector or on the generation side.

And on the emissions side, yes, there is a public health consideration. And that may sound altruistic in some respects, but fundamentally to the extent that we can lower emissions from one sector it provides greater choice in terms of economic trade offs and what's cost effective in other sectors. And it also provides the opportunity for enhanced growth in terms of industry and population.

And so that's been the foundation or the rationale for our focus in that area as well.

**MR. KENDALL:** Well, I commend your program.

**MR. WEINBERG:** Any other questions, anybody? Okay. Thank you

very much.

It's interesting that the word "flexibility" and "trust" has come up because I think they're the opposite sides of the same coin. You don't get one without the other.

The other, I just can't pass this up without making a comment about lawyers. My own experience was a discussion with lawyers in a sense that I said, look, I'm an R&D director, my job is to take risks. And he says, look, I'm a corporate lawyer, and my job is to remove all risks. So right off we were at opposite ends of a discussion.

**MR. KENDALL:** Some of my best friends are lawyers.

**CHAIRMAN IMBRECHT:** It sounds to me like you learned something about politics, too.

**MR. WEINBERG:** The next presenter is Hank Leibowitz who is the Vice President of Exergy, Incorporated, and they're the company that have been involved in the research and development and demonstration of the Kalina cycle. And he definitely is responsible for commercialization of thermal applications of this technology. And prior to this Hank worked at General Electric and later at Pratt and Whitney on advanced turbo machinery components.

Hank.

**MR. LEIBOWITZ:** Thank you. My comments are going to be rather direct, succinct and explicitly toward the requests in the paperwork that was submitted to us.

Clearly the goal and mission of Exergy is very very singular and

focused. We're in the business of developing and commercializing the Kalina cycle technology as applied in all fields of use. And we define those as the thermal generation power applications. Namely: gas, coal, geothermal and solid waste. We don't deal with anything like hydro electric or solar and so forth.

For those of you who are not familiar with the Kalina cycle and by way of introduction it is a technology of a family of cycles really that offers substantial improvement and cost savings compared to existing designs primarily through process related innovations as opposed to a component development that leads to higher plant efficiency.

And the way it's done, and I would certainly am not going to go into that now, it is done with processes involving ammonia water compositions, changing that composition and a lot of recuperation within the plant. Very good, what you'd call heat management.

Insofar as the public good is concerned, the Kalina cycle really is the only thermo dynamic power cycle that has been developed and is now being commercialized in the 20th century. It addresses about 70 percent of all power applications worldwide to the extent that gas, oil and coal are the work horses of power, the Kalina technology can be applied to it.

In the process of getting to meet those goals and missions we have set forth some objectives, and how they interplay with the RD&D is shown here in this slide. We set out to build a pilot plant to confirm that the process works. We made a lot of representations and claims, and we needed to have a way to show the community that it works.

Well, we built a three-megawatt demonstration plant with the unwavering staunch support of the Energy Commission, and that project was completed in the '91-92 period. There it is down in Southern California. It is operational for the last five years, and it is a success in the RD&D program.

That led to commercialization by way of licensing the technology. And as soon as that pilot plan worked and the process was confirmed, we gained the intention of the industrial community, and, in fact, immediately thereafter have licensed major global players. General Electric, ABB, Ansaldo, and EBARA. That happened in the 1993-94 period. That process is really not a candidate for RD&D. It's all internal business and commercial type of activities.

Going beyond that, though, the licensees needed design data for commercial scale-ups, specifically materials, heat transfer ammonia water properties data and so forth. That activity has been ongoing since '92, and, in fact, we have built a heat transfer facility again with support from the Commission, with SMUD and the Department of Energy, and that work is going on and data is being developed for our licensees.

Following that then we have to go directly into a commercial demonstration in each field of use. That activity is well under way. And again there is a candidate for RD&D.

We see a geothermal project on the horizon in the State of Alaska. We see two gas projects. I was hoping to say there'd be a geothermal project in California, but it's very difficult, as you all know here, to fund renewables programs in this environment costwise. We have two gas projects, we've got coal and the

waste project is under way in Japan.

And then for commercialization implementation, of course, we don't see any further need for any RD&D. But clearly in the development from pilot through commercial demonstration RD&D is entirely appropriate.

The vital elements in a good R&D program, first one has to evaluate the worthiness of the technology. That has to be far and away the most important of the criteria. It has to have the most impact for public good. It should be wide, it should be deep, and it should be of long-term benefit.

Implementation is very important. It should have a sort of a catapult effect. It should be the link pin clearly just to provide subsidy to continue a program that will continue to need subsidy. And all of you in this room know of programs that fall under that category. Doesn't make any sense or doesn't do any good for promoting long-term improvement in efficiency, reduced generation or emissions.

What are the measurable successes? I see them in a few areas. Would the RD&D program lead to some commercial activity? In our case it's licensing, then into market penetration, and then, well, maybe you can do it by just showing reduced cost, improved efficiency and just get from a capacity cost of X to a capacity of X minus Y, or increasing efficiency from X to X plus Y. That way showing how the RD&D program manifests itself in some quantifiable improvement.

A point that was made earlier the technology ownership should reside in the hands of the developer. To do it through some third party really doesn't make any sense. We have gone up against a lot of false starts and hit brick walls, and I think that that is not a recipe for success at all.



And finally the RD&D program structure should be explicit, well defined, and it should really require out-of-pocket expenses as opposed to people trying to indicate that, well, in kind matching will suffice. And it's much more difficult to track those kind of programs.

Insofar as lessons learned are concerned, a good R&D program contains obviously a good plan. The combination of the technology, the team, the budget, schedule and work statement should all be lined out and evaluated on their merits.

A good program should have objectives that are crucial to the ultimate success of the technology. Clearly in order to get the technology into the marketplace that particular RD&D program has to be the place where success is achieved. It doesn't do any good to make a demonstration here when you've left another question unanswered.

And a likelihood of success. You certainly don't build plants being absolutely certain or guaranteed that there were, but there should be a highly likelihood of success. That is to say the objectives need to be real.

Is coal fusion worth funding? Yeah, but not this type of forum.

What about things like MHT that have been looked at for many many years. They might work on paper, but likelihoods of success are really not there.

And the application should be generic. We really shouldn't be looking at things that have a minutely sliced portion of the marketplace. To have things that are funded for the public good really require a broad spectrum.

And finally the goals and objectives of the RD&D program should not depend on external developments and changes. For example, one should not be

funding RD&D programs for technologies that assume the price of gas will be five dollars a million five years from now or power will be ten cents and so forth.

We must look at the market as exists today. And the corollary to that is that don't make the program dependent upon the achievement of technologies in unrelated areas. In order to make a program successful don't assume that there'll be some materials that today don't exist but are needed five years from now but others will do that. I've heard that term referred to as "unobtainium."

You can't build an MHT generator that runs at 4,000 degrees Fahrenheit. From a process standpoint, that's fine; but nobody has developed materials that can sustain that type of temperature.

Those are my remarks. Thank you very much.

**MR. WEINBERG:** Commissioner Rohy.

**COMMISSIONER ROHY:** Mr. Leibowitz, I think what I would call those last comments, I call them the one miracle programs. You don't want a two miracle program.

**MR. LEIBOWITZ:** That's right. Very well put.

**COMMISSIONER ROHY:** But I have an issue that maybe all the panelists will consider as we go along. The Energy Commission has been very much a partner of yours through the project, and it's turned into relatively successful project. And that's one founding statement.

The other one is Mr. DeAngelis and I have talked about this for awhile, and we have a definition of public goods R&D. And for political reasons we had to put that together versus private R&D. At some point your project went from public

goods to really private goods. You have a product.

**MR. LEIBOWITZ:** Yes.

**COMMISSIONER ROHY:** Where did that happen?

And by the way, let me add one more foundation remark in there is that all our speakers today are talking about alliances. And don't get me wrong to say that we should only fund public goods and then stop and then leave them for someone else to pick up, but politically we have to start addressing this issue of where does a public good turn into a private good?

**MR. LEIBOWITZ:** Good question. I'm not sure I could draw the line for you.

**COMMISSIONER ROHY:** At this point are you pretty much self sufficient? Never mind, scratch the question.

Excuse me, but we need to answer that question where that interface is, and we need to be able to articulate it. And I don't know how to articulate it at this point.

**MR. LEIBOWITZ:** Well, right now Exergy has had a few staunch supporters. The Commission has been one of our earliest and strongest. We have found that alliances with other national organizations hasn't worked out.

In one case the ownership of the technology became an issue. And so with the combination of a lot of sweat, a lot of equity, and a little bit of support. Right now we're sort of on the bubble, have peeled back the first layer of commercialization, but I suppose that's where we are at this point.

**COMMISSIONER SHARPLESS:** I just have one very quick question.

I continually try to draw together the themes that people seem to be saying to see if I get some continuity, something that emerges from our conversation here today. And market research seems to be one. You've cast it in different terms, but I gather from what you've said knowing what your customers' needs are and so forth and so on that market research is also high in the order of things from what you see as vital elements in successful programs.

**MR. LEIBOWITZ:** Well, the market research is, in our case, is kind of straightforward. We look at the power, at the power picture globally, we see the generation, and we see where, we see where improvement is needed, and we focus in those areas, and those are the ones that I mentioned here.

**COMMISSIONER SHARPLESS:** But you talk to your customers basically. That's how you do your market research?

**MR. LEIBOWITZ:** Yeah, but I would say that this thing is rather straightforward. It doesn't require a whole lot of ingenuity and research to realize that if you're addressing a problem statement where 70 percent of the world's power is generated, if you can make a quantum improvement in generation costs, you've got yourself something that really will sell.

It doesn't take a whole lot of iterations and a lot of depth to realize what the result might be if it works.

**COMMISSIONER SHARPLESS:** Okay. And I also wanted to ask you about one of your bullets. It says recommend, this is in the RD&D program structure, recommend significant contractor cost share.

**MR. LEIBOWITZ:** Yeah.

**COMMISSIONER SHARPLESS:** A minimum 50 percent.

**MR. LEIBOWITZ:** Yeah. Well, that's to make sure that the people we're, that the Commission and others are dealing with, are serious. That the research program in and of itself should not be the solution. Should not be the answer.

**COMMISSIONER SHARPLESS:** So this is your approach to get to the issue of getting over the wall.

**MR. LEIBOWITZ:** Yeah.

**COMMISSIONER SHARPLESS:** To have successful research commercialized.

**MR. LEIBOWITZ:** Right.

**COMMISSIONER SHARPLESS:** Okay. Thank you.

**PRESIDING VICE CHAIR RAKOW:** As we move through the panel, I'd be very interested in the question that Commissioner Rohy brought up of where the public goods support, governmental support, stops and where the private for-profit takes over, and also any comments on this market research issue in, perhaps maybe not in the broader sense because I think maybe that's understandable market research for the sake of selling a product.

And I guess I'm a little bit leery of public goods research and development funding going into what I call very definite short-term for profit type of projects rather than long term public goods that might take a few years to work out.

I think that Dr. Hanson this morning in his paper made a very good

point when he was quoting the Provost [phonetic] saying that many of the technologies that have most transformed society sprang up from unexpected and fundamentally unpredictable sources. And sometimes you cannot predict which the winners are going to be.

Now I recognize that the panel this afternoon are R&D private industry, and we're approaching it from that point, but just when we have a complete panel wrap up and discussion I'd like to know your opinions and some of those thoughts.

**MR. WEINBERG:** Thank you, Commissioner Rakow.

Dan Shugar is the next presenter. And he's responsible for business development at PowerLight, and with an emphasis on project development, customer relations, strategic corporate planning and government relations. And the reason he does all those because there aren't very many in his company.

I knew I couldn't get away all day without being a little bit testy about things. But when you go to the track, you either bet on horses and you bet on jockeys, and Dan always reminds me of a jockey that's got a good horse under him. So, Dan, I'll give you an opening here.

**MR. SHUGAR:** Thanks, Carl. You left out that I worked for Carl for a number of years, and that's why he has license to abuse me like that in public.

Well, thank you for the opportunity to address you today.

PowerLight Corporation is a small privately held company. We're based in Berkeley. We have a very high density of engineering and architecture disciplines. In a way we're very similar to the Alzeta Company as it might have

been ten years ago or eight years ago. I appreciated your remarks. Our business is exclusively solar electric photovoltaic systems.

My comments are I'm going to keep beating the same drum throughout this presentation, and that is there's a vacuum in the public goods research area in terms of near term product oriented focus. There's a very heavy federal emphasis on long-term high risk, potentially high pay off area.

If you look at the quantity of funds that are under discussion, it's a drop in the bucket in the grand scheme of obviously all the R&D resources that are available. So we have to look at where you can obtain the maximum leverage for this investment that's under contemplated to be made.

Our focus and how we use R&D and similar to Alzeta, we, about 30 percent of our revenues come from R&D, including we have one project with the California Energy Commission, is that we are very product oriented in terms of taking, not delving into fundamental research. That's being done by national labs. That's being supported by DOE. We want to take products that are near commercial. Make a commercial product and get them out and get them commercialized.

An example of a product we did that with is a solar roof system we developed. This was with some support from the California Energy Commission. Now, again I want to emphasize product focus versus technology focus. There are hundreds of millions of dollars a year spent researching photovoltaics. In this case solar electric systems. Our view was to say we can make a relatively small difference in that overall technology driven business. What we wanted to do is create a product out of it.

And so we created essentially a roof tile that's used on commercial-type applications using some support from the California Energy Commission ETAP Program and were able to essentially commercialize that quite rapidly and get projects out on the street.

We've done projects from New York to Hawaii and a few international projects. Again, very small company. If we don't get this technology commercialized out on the street, our doors close.

There's no, and I'm sure this is true of many smaller companies, we are highly motivated to get the stuff out and start making some money on it. We work 70 hours a week. We've got to get it out or, you know, you know when you're paying thousands of dollars a month for insurance to keep your doors open, that's not something you can wait on a sort of abstract, you know, well, someday maybe this will get commercialized. No. We need it out. We need it out now. So I want to keep emphasizing that.

In terms of this specific technology, we actually in partnership with the Sacramento Municipal Utility District, we've developed several projects. I'm not going to go into those, but I think it's helpful to see what we're talking about here in terms of how to get projects out on the street. This is a project we completed earlier this year. It's in Elverta, California, with the Sacramento Municipal Utility District.

We found that the partnerships between utilities and the Energy Commission has been very helpful in getting projects commercialized.

I mentioned we need to fill a vacuum that exists for applied R&D. The DOE emphasis, I'm not going to say it's right or wrong, but it's really at the



fundamental level. Our opinion is that with the limited resources we're talking about we need to look at what our competitors overseas are doing. They are looking at very very practical, very very applied R&D that's going to be put out now. We need to respond to that.

Another interesting thing, as you evaluate different technologies, how do you do that in a way that's consistent. And I would suggest we need to do that in a way that's consistent among value bins.

Let me clarify what I mean about that with a photovoltaic example. Here's three ways to skin a photovoltaic problem. I was going to say skin a photovoltaic cat, but my wife hates that expression. And it also gets at some of the work we did at PG&E in distributed power.

The project on the left is a central station, five-megawatt central station photovoltaic project. It was built in the plains near San Luis Obispo in the early 80's. That technology really only generated two levels of benefits. It provided energy into the grid, and it provided some level of capacity. Its value was about three cents a kilowatt hour. After the project was purchased by other owners it was promptly dismantled, and the panels had much higher value to be sold for homes in Mexico. And a lot of the panels were sold into that application.

Another, same technology, photovoltaics on all three, but I want to emphasize that when you do the evaluation we need to consistently look at which bin you're evaluating them.

At PG&E in the PV USA project a distributed application to provide additional value to the electrical system was conceived and built. This is the

Kerman Station near Fresno.

And in addition to the energy and the capacity it had other values. It saved electric line losses, provided voltage support and some level of T&D benefits. That dramatically increased the value.

Still, though, we believe there is a high value area, and that is customer sited facilities. This specific facility uses our photovoltaic roof tile, but there's other technologies out there that are also fit this mold of customer sited benefits. In addition to these other benefits it could save roofing material, provide insulation benefits, provide other benefits to the building.

My point here is not to say we should do customer sited photovoltaics, but rather than when you evaluate technologies you evaluate them consistently in each value bin. For example, it would be inappropriate to evaluate a photovoltaic customer sited against a central station solar thermal project. You would evaluate the central station photovoltaic against the central station because it's the same value based application.

Okay, I'm going to wrap up pretty quickly. Lessons learned. We, again, agree with a lot of the earlier comments. Avoid technology focus. Rather focus on products, commercializable efforts that yield something that has an end date. You want something, for example, the ETAP Program, we think, be well structured. It has a beginning, a middle and an end. And at the end if you're not commercialized, don't go back to the well. And we firmly believe that.

We believe there's a lot of value in focusing on product development with smaller companies and medium sized companies. Not that large companies

don't do valuable research. We believe they do. But rather you have a very, you have more bang for your buck, and more, we believe, motivation in getting something out in the near term for survival.

Finally, focus on the value chain. Not on cents per kilowatt hour. Consistently compare the technologies across where they offer the same application mix.

I'm going to conclude with this chart which I'd like to claim authorship for, but I did read this in a paper a few years ago. The concept stuck with me very well. What is the appropriate criteria you use to evaluate which projects you're going to fund.

If you sort of look at the portfolio of technologies, these dots all represent technologies, projects, things. There's projects that have very high uncertainty but require a fairly low level of investment in order to commercialize them.

Then there's projects that have very well understood economics. The uncertainty is low, but they might require a fairly high investment doing an actual demo, building a five-megawatt plant of particular technology.

The premise of the paper was that the appropriate evaluation perspective to use on the technologies that had a fairly low uncertainty but very high investment is just straight return on investment analysis. That seems to be pretty clear. And primarily the private sector is capable of doing that and accommodating the risks.

For highly uncertain projects that require a fairly low level of

investment on any one particular program, the appropriate evaluation is to just say it's part of our technology program. We will allocate X, you know, millions of dollars for this specific fly wheels or this specific technology. And really the federal government is doing that through the national labs and others.

As Bill Marshall indicated earlier today, they have programs in thin film, solar, and they might say our budget in this area is X per year. And that's an appropriate way to do that.

Sort of the really interesting place is in the middle. And that's where your challenge is I believe. It's really in the area where the uncertainty is sort of the medium level. There's going to be some strategic benefits as the previous speaker indicated. You might not know what all the benefits are the technology. Therefore, it's not really appropriate to do a return on investment analysis.

You have to look very carefully, and I would propose the key there is look at the value chain, not necessarily straight on a comparative cost for the reasons we discussed earlier.

Thank you.

**MR. WEINBERG:** Commissioner Sharpless?

**COMMISSIONER SHARPLESS:** Yes. A lot of food for thought there. But again, I'm trying to fit the pieces together, and I'm trying to see if what you've said goes contrary to what we've heard from some of the speakers. It sounds like it does. Am I right?

**MR. SHUGAR:** I'd say in general most of my comments did, were in concert with some of the earlier speakers, although some were, I'd say some were

opposed.

I think we agree from the standpoint that the project, whatever level it funded, needs to be well defined and well contained. And you don't want to be funding organizations that are coming back to the well again and again for the same technologies.

What did you hear that was different? Perhaps I can respond to that.

**COMMISSIONER SHARPLESS:** Well, look at the value chain, and perhaps you're just using different language, but it would seem to me that return on investment is what the market tells you. A market tells you, you know, that we're looking for a return on our investment, we're looking to turn something around pretty quickly, we're looking for success. How do we define success. We define success by bringing it into the market.

Well, you're saying similar things, but you're saying instead of looking at the technology, you look at the product. So that makes it sound as though we moved sort of beyond technology funding, research and development of technology funding.

I think I've heard speakers past looking at technology funding, and looking at product. That makes it sound like somewhere in the matrix it's around the demonstration range; right?

**MR. SHUGAR:** Yeah. I think we were in concert from the standpoint the comments I've heard today have been primarily focus on near term commercial products. And we definitely agree with that. We don't think return on investment analysis is inappropriate. Only the point of this chart is simply that whatever level

of analysis you do, be consistent in how that technology's going to be used.

For example, in a central station application, the value of power might be three cents a kilowatt hour today. And regardless of which technology it is, if they're in a central station application, they're all going to have that same basic value.

If, on the other hand, it's a customer sited application, the value's going to be higher. And, again, if the customer's using a return on investment analysis, that's fine. The only point of this chart is don't compare a central station technology with an end use technology because it's mixing apples and oranges.

It sounds like a very intuitive comment, but five out of six RFPs we see on the street want to say, hey, we want to look at everything on the same level playing field. That's fine, but do it within each application. Look at customer sited on same level playing field. Look at central station on the same.

**COMMISSIONER SHARPLESS:** Um-hum. I have another sort of question and point and maybe provocative comment.

My experience in California is that California often leads the nation and the world in a lot of technology. You say, you know, the feds are spending a lot of money on RD&D, you should focus, you know, and use your money in those areas where there's not a lot happening. And that's how you gain additional value.

Well, quite frankly, if we were to wait for the feds to deal with some of the issues in California, I don't think we'd be as far along as we are on some. Now maybe this is just a bias. I've also been back to Washington and have pleaded with them to fund certain things, and they go, that's California. They're crazy. You

know, that's California. We're on the other side of the beltway. We know.

So tell me why again I should give up my leading edge in my envelope pushing and count on the feds to deliver some of the RD&D we think we need here in the State of California? And, quite frankly, where the industries are located?

**MR. SHUGAR:** Oh, I don't think we should give anything up.

**COMMISSIONER SHARPLESS:** Sounded like you were saying that.

**MR. SHUGAR:** Let me clarify my position. Where California, I think, has led is in exactly what we're advocating. Commercializing things that are near ready, almost ready.

Example. Wind farms, Luz, Alzeta, you guys built the three-megawatt plant with Energy Commission support. That's exactly what we're advocating. Commercialization with private companies like us.

Where I wanted to differentiate from DOE is their focus is much more in the basic research side. And I'm not being critical of that. I'm just saying that's what it is.

There is a report by the House Science Committee last month again saying we need to go back to very basic, you know, investigating more materials as opposed to doing a real plant.

I'm saying do the real plant. Stay in a leadership position. Take the industries that you've developed, and, you know, let's go to the next level. We think that's where we want to be.

**COMMISSIONER ROHY:** If I could comment on Commissioner Sharpless' remarks there, too, is that when you say we should focus on near term

products, that gives me a hard edge here to play with. Because again I'm going back to this public interest RD&D, and if it's a near term product, I can't see why public interest funds should be used for that.

Could you explain to me?

**MR. SHUGAR:** Yes, and thank you for getting back to that. There is, it really needs to be sharply defined.

In our case we had this idea for the solar roof tile product. We're very small, privately held company, half a dozen people, did not have the resources to develop that. The Energy Commission through the ETAP Program provided us some level of seed money to fully commercialize that product, do projects with companies like SMUD and take it to the next level.

That product development window is extremely well defined. There's a beginning, a middle and an end. The point at which you reach the transition is at the end of that project. In this case it was an ETAP project.

**COMMISSIONER ROHY:** If I took the words "small company" out of your argument and put "large company" in, would the argument hold?

**MR. SHUGAR:** Having come from some large companies that tried to do R&D, I mean I really hate to say, no. On the other hand, my experience is that you get a lot more value. You get a lot more bang for your buck with smaller or medium sized companies.

**COMMISSIONER ROHY:** Just trying to test whether it's the large versus small company or whether it's near term versus long term, or public goods.

**MR. SHUGAR:** Well, I think sometimes they're the same thing.



**COMMISSIONER ROHY:** Or high risk versus low risk.

**MR. SHUGAR:** I've never seen a graph of this, but it would be nice to see product commercialization cycles a function of the size of company.

In our case we don't have the luxury to be able to wait and take years and years and years to develop something. We need to need to develop it, get it out, and I think in the case of, I would invite during the panel session, the other private companies to respond to that as well.

**COMMISSIONER ROHY:** Well, you certainly have caused us to take attention to this.

**MR. SHUGAR:** Good. That was the point. Thank you. Any other comments?

**MR. WEINBERG:** I must say it's interesting to me to listen to all these because all of them seem to be talking about bridging that gap between R&D and commercialization. Every one of the topics dealt with how do you get looks like a better product moving. It seems to have or does have a public interest component to it when somehow or other the private sector did not pick that up.

I'd be interested in a discussion later on why venture capitalists did not fund all of these things that we've heard about. So it gets back at your question, Commissioner Rohy.

Since we've just heard from what I guess would be the smallest company on the list, I guess we get a chance to hear from now the largest company on the list. And the next presenter is Dr. Larry Papay who is Senior Vice President and General Manager of Bechtel Technology and Consulting, Inc., which certainly is

a worldwide engineering and technology firm and construction firm.

His responsibility is monitoring and developing new business opportunities and providing technical and management consultant services on a global basis.

And I know Larry from a number of years back because he came to Bechtel from a number of years at Southern California Edison at which time at one time when I first came to the utility business he was manager of research for Southern California Edison. So I learned a lot from him then.

Larry.

**MR. PAPAY:** Thank you. Actually I was going to start out and say that we are also a small privately held company.

[Laughter]

**MR. PAPAY:** What's the definition of small? Small meaning the number of owners in the company, it certainly qualifies as a small company. So we are a small company.

Actually my comments will probably, hopefully, address a couple of the points that you raised because we find ourselves in contrast with all of the other speakers so far.

We tend not to focus on our own intellectual property and ownership and development of products. We do what I call the middle part, the bridging from something which has come out of the laboratory and which has to make its way into the commercial marketplace. And we work with clients and customers in what I'll call "reality engineering." In trying to take what has been done in glass and put that

into pipe and hardware and find if it will make it into the market.

I've submitted some comments, and I'm just going to paraphrase some of the introductory remarks there and not go into them in detail. But let me just first talk about where public good is versus private good, if you like, and give you two examples which I have in the paper.

And that deals with, first one, nothing to do with energy per se but with automated highways. We are involved with a very large consortium, including General Motors and others, in an automated highway program which is almost exclusively funded by the Department of Transportation.

Why? Because it is clear that the product there does not have a commercial value per se, but it has a public good aspect to it.

Some of the devices which will go on board the cars are excluded from those programs or that project simply because the collision avoidance systems that GM and others are coming up with have a market value, and they can afford to develop those on their own hook because it increases or enhances their competitive position.

Another example use the power industry as a whole, having been involved with it for over 25 years, I've seen the whole system go through a series of cycles where there was very little federal support, very little utility support, pre-EPRI days, and in fact the manufacturers had to do development on their own hook except in the case, as it turned out at that time, of nuclear power because there was a governmental program, because of military needs which basically subsidized the development of light water reactors for civilian application.

With the oil crisis and with several other things which occurred, such as the brown outs back East in the late 60's, the need for utility R&D and power systems R&D, electric power R&D, whatever you want to call it, became greater. Federal programs were increased.

The utility industry came together, created EPRI, and the manufacturers of the equipment found that there was a fountain of money. And that fountain of money existed both in Washington and in Palo Alto. And in point of fact, their programs were focused on the extent to which they could leverage their own funds with these public funds to accomplish research and development and commercialization of products.

In point of fact today, with the reduction on the federal level and the reduction, also, on the utility level, and the restructuring that's occurring you find, we do find, that many of those same vendors are spending more of their internal dollars in those cases where they see a clear commercial product.

So for example, does a General Electric look even to get any sort of outside support for improvements in the frame seven machine. The answer is no. It can do, it can afford and will do that sort of research because it's in their economic self interest to do that because they will have a commercially viable product.

In the cases where technology is desirable from a public perspective but the path to an economically attractive commercial product is not clear, then the role of public support for that technology becomes important.

Many people have brought this question of commercialization up, and not to belittle it, but if you look at a Gant chart of an awful lot of R&D programs, in

the lower righthand corner there's a triangle, and it says commercial, commercialization, or something like that. That if you do everything up until that point, commercialization will occur.

Well, it may not occur. It may take a commercial demonstration to accomplish that, or some sort of market introduction to accomplish that. And I think the important thing there looking at that end of the food chain from your perspective is to look at the difference between what is economically competitive in the marketplace and what the cost is for that product at that instant in time. And what the cost will be for that product as it goes through the first end units for introduction.

There, on the commercialization tail, if you like, it's in a very important point. Why don't the venture capitalists come forward for a lot of these companies. Because the venture capitalists can see their money turning over in very short periods of time in other markets. Biotech, software, etcetera, where they can see their money turn over in one to two years.

When you're dealing with hardware development, your time frame tends to be longer than that. And to have the staying power and bring that technology to a commercial point takes a little bit more time and needs a little bit more support.

So from my perspective I think I would characterize the public good as providing some of the funds which are required to make a technology, whether it's technology in terms of process or product is, I think, a fine point and not to belabor that. But it's the funding required to be able to bring something which is deemed to

be in the public interest from a non-economic position to an economic position.

Because if those monies aren't spent, then that will be a piece of R&D that will end up on the shelf. And until gas prices go up or something else happens and that becomes economically attractive, nothing will happen to it.

So where you can best use your money is to leverage those funds into technologies. And I think it's small companies and large, by the way, and you need a portfolio approach to what you're doing. Leverage the funds that you have with the private sector funds and funds out of Washington or elsewhere, from EPRI, GRI, etcetera, to be able to come up with viable commercialization programs.

The program that you're putting in place speaks of RD&D, so it speaks of the continuum from research through development to demonstration. I think you've heard the panel say there's a piece of a "C" on the end of that, too, to make sure we don't just get it too demonstration. And if there's another little push that's needed to get it to the commercial marketplace, that's still an appropriate role for you to play.

I think you can find the level of private sector support and interest in a given technology by the extent to which they're willing to step forward and financially support. Especially as you get out closer and closer to commercialization.

I've been involved in a couple of projects where the funding we sought from outside, i.e., from government, whether it's Washington or within the state, is that portion which is between what is commercially viable and the true cost of the product.

So there's some fraction there that's not economically attractive, and

because of the time the market it's hard to internally eat that and wait until you have sufficient orders down stream. So it's a very critical period, and it's not necessarily large dollars on a case-by-case basis, but they are very critical dollars that are needed.

I don't know. How am I doing on time, Carl?

**MR. WEINBERG:** You got three more minutes.

**MR. PAPAY:** Three more minutes. Actually I'm going to get you to help you out on your schedule.

I would like to close with a comment which I came across over the weekend which I quoted in the comments, but it's from the Aspen Institute Report on the Transform Structures of the Energy Industries. And they did speak in terms of the government role in research and development, and their use of government was more federal than anything else.

But they did say government collaboration with industry and with other governments can bring great returns on R&D investments provided projects are defined and managed well. Collaboration between government and industry will also be essential to gathering industry support in strategic energy technology areas; e.g., fuel cells, batteries and renewables.

But since dramatic change is occurring now in the energy industry and in the public sector simultaneously, it is important that government and industry collectively review available mechanisms for collaboration and seek to increase the efficiencies with which future R&D resources are used.

I think this is the challenge which is in front of you, and holding these

hearings I think is a commendable way to begin that process. If there's any way we can help you as you go through this, be most happy to do that. And stand for any questions that you have.

**COMMISSIONER ROHY:** I just want to reiterate what I think I've heard in the last two speakers, and I appreciate all your views on here. It's helpful to me individually at least. Because I heard Mr. Shugar talk about short-term product developments, some real nuggets that are just waiting to be taken to marketplace, and then your talk was a little bit on the longer term issues. You said, well, some of these power issues, power generation issues, are longer term projects, may take more time, and we should invest a delta in there.

In addressing your specific arguments, there's some industries, and I don't want to start to get into details on which industry right now, or technologies, where that delta has stayed the same for 25 years. And we write it down because we're chasing a moving target.

**MR. PAPAY:** If I could answer there, shame on us. Shame on us. Shame on us if, one of the things when I was back at Southern California Edison and we had an R&D program, and I said each year I wanted to go in front of our management committee, pull out my gun and shoot a couple of horses. Because I thought it was important to always go through and clean the barn, okay.

You can't continue, there are people, somebody talked about the R&D, I'm sorry, I forget, not the professional, but the mercenary. That's exactly, that's exactly the situation.

I think if you live off of R&D, that's exactly what can happen. That you



can find a nice niche and you could ride that niche for an entire career.

I think if you're putting up your own corporate funds, and whether that's your corporate funds or our corporate funds or any one of the panel members' corporate funds, if you're not closing the gap on economic reality, we'll get the gun out and shoot that horse and send him off to the glue factory.

I hope I didn't offend any animal lovers in the audience.

But the point is shame on us if we let a technology just sort of sit there and continue to always be X points from the margin. If there's not a clear path to commercialization, then I think you should end the program. And sometimes that's difficult to do, but that's a reality of life, and it's a reality we face in our company every day.

**COMMISSIONER SHARPLESS:** Like a follow up question. You alluded to Mr. Shugar's comment about product versus technology, and you said that was a fine point. Would you like to elaborate on that?

**MR. PAPAY:** Yeah, I think it's a definitional issue. You start out with technology. Technology meaning photovoltaic, all right. Then you end up I can take photovoltaics, and I can work in the laboratory to improve the type of material I have, the efficiency, I can talk about concentrating photovoltaics, I can put them in a raise, I can put two axis movement on them, I can do a lot of things in talking about how I'm going to use that technology; but at the end I need to have a product.

So again it's just, I think, definitional of where you are on the chain of going from technology to a defined product. Because everything else that was talked about here ends up being a product. The Kalina cycle is a product. It's a series of

components and systems put together to perform as a product.

If you talk about low NOx burners or gas turbines, they are products. But you start with technology or technology improvement, and you end up delivering something in the marketplace.

**COMMISSIONER SHARPLESS:** But doesn't that go back to a lot of what we heard this morning from organizations who have RD&D funding mechanisms. They said be clear about your objectives. When you do projects, make sure that you know what your end result is. Are we talking all the same language here?

**MR. PAPAY:** I think we're talking the same language. It is most important in, we call them technology road maps, we work with our internal customers who, by the way, deal with their external customers in terms of market analysis, and understand where they want to go and define what the technology need is at some point in the future. And then work backwards, or work forwards, both, to find the program to get you to a certain end point.

You may miss it, but you have milestones along the way. And as you hit those milestones, you've got financial as well as technical milestones; and if you're not getting the bang for the buck so to speak, you've got to ask yourself, this is the hard time, ask yourself the question: Is it just that convergence is slower or is it that I'm going to converge asymptotically and really never get there.

And you need to have reviews on some sort of periodic basis built upon the milestones in the program for that particular technology/product. And spend the time to monitor that.

**COMMISSIONER SHARPLESS:** Well, there's that, and then there's this other angle. I think Carl brought this up about flexibility trust. The flexibility issue. Here we've got this system now where, you know, we're clear in our mind what we're trying to accomplish. We've got individual projects. We've clearly stated what the objectives of those individual products are. But be flexible.

**MR. PAPAY:** The point, I think the point is, I'll go back to what I was talking about in these plans, you need to be flexible if there's good and sufficient reason to be flexible. I'm not saying if somebody says, well, I missed my target, and I've spent twice as much money as I thought. I don't think flexibility is to say, oh, what the hell, excuse the language, just keep going. We'll give you some more money.

I think you've got to ask some very hard questions. You may want to redefine a program. You may just want to cut it off.

The flexibility works both ways. It can work in a cruel sense if saying, I'm sorry this technology has come to the point where it's not in our mutual benefit to keep funding it. Or you can say you've really shown promise. You found, you uncovered two things that we didn't even know were going to happen. And I understand that. You have advanced the state of the art, you do need some more time, and we'll work with you to work that program out.

So I think the flexibility is there. The trust has to be there, too, because people have to tell you we blew it, but we blew it for some very good reasons. You do the evaluation on those reasons, and you come to the conclusion, yep, you're right, or, no, I'm sorry, you're wrong. We just can't go on with that.

That's where it comes in I think.

**COMMISSIONER SHARPLESS:** Thank you.

**MR. WEINBERG:** Let me ask you one other sort of question, Larry.

**MR. PAPAY:** Okay, Carl, you're allowed to ask one question.

**MR. WEINBERG:** Yeah, one question. And that is something that I think the other people have hinted at and you certainly hinted at, and I hadn't thought of it this way, and that is the use of public interest R&D in order to speed up basically the acceptance of a product or a technology that's in the public interest, right?

**MR. PAPAY:** That's correct.

**MR. WEINBERG:** Sort of a speeding up, it's that non-economic to economic bridge against speeding up the introduction.

**MR. PAPAY:** All that the economic evaluation say, you know, if I put a dollar today, what's that dollar worth five years from now or three years from now or what have you. Will I ever get that dollar returned. So the time the market is as important as getting rid of that delta.

And if by the proper infusion of funds you can shorten that time to market to have a commercially viable product, you would increase the economic attractiveness of it sooner to the technology developer.

**MR. WEINBERG:** Thank you.

**MR. PAPAY:** You're welcome.

**MR. WEINBERG:** The next presenter is Dr. Barry Butler, and he's Vice President of Science Applications International Corporation, Manager of Materials

and Structures Division. And SAIC is a technology consulting and development firm, and they have offices across the US and overseas.

And before joining SAIC, Dr. Butler managed the Solar Materials Program at Sandia National Lab in Albuquerque. He's been involved in solar thermal technology development at NREL. And he is the past Chairman of the Solar Energy Industries Association. So clearly involved with solar.

**DR. BUTLER:** Thanks, Carl. It's hard to characterize SAIC, but for most people it's the McDonald's of science basically. It's a two billion dollar company made up of a lot of five million dollar pieces. You know, for 15 or 20 people that are all trying to bring technologies to the marketplace.

The company has historically done 80 percent of its R&D for the federal government. Lots of military R&D. And lately they've recognized they're sitting on this gold mine of R&D, and now we're working together with venture capitalists, actually capitalize, you know, elements of that to take it into the private sector.

Now, when I sat down to think about this problem, I apologize for the chart, it's a little small, but you do have copies of it in front of you, I went and looked and said: Where are we?

In the energy business we spend about 1.1 percent of our total expenditures on R&D. You know, the telecommunications industry is up at eight or nine percent. I mean they're moving fast. And the computer industry is way up there. We're way down. And the question I ask is why are we sitting so low. Why aren't people making investments. And the answer is people are happy with things the way they are.

If you look at that chart, Dan Shugar's put a whole bunch more stuff on that, but it says the price of energy doesn't reflect the true cost. We have the, you know, what we have now is the consumer pays the cost of exploring, mining, recovering, refining and delivering and a conversion device. The pollution, the health costs, environmental restoration, all those other costs, they're just not in the equations.

So people are highly motivated to add them to the equation because it adds costs directly. And Dan has put, you know, three or four more things down in here.

If the true consumer represented the right market signal, because he saw the right price, then we wouldn't be having these hearings. Because there'd be a lot of R&D going on that was aimed right at products. You wouldn't have to push things. It would be market pull.

So my definition of public benefit R&D is what it does is reduce the price shock by offering timely alternatives. When the price of copper went up, PVC was approved for water pipe in houses, and the price of copper fell.

So what we're doing is putting alternatives on the table so when the price shock comes there's a range of these alternatives that will kick in and stabilize the price. Otherwise we're going to see, you know, prices related to our dependence on oil and coal and the resources that are there.

As I looked at what we had to do to be successful, we have to have some national goals. And DOE has done a good job. They first started out with the energy independence, and that sort of fell apart. Carter said let's do that. We're now

well over 50 percent in imported energy.

And so the Solar Energy Industry Association got in and said let's have 20 percent solar by the year 2020. That's just a goal. And let's capture 50 percent of the world market.

And for California what that means is, you know, should California adopt a goal. Something that you can put up on the wall and say that's what we're all working to.

You know, make California a net exporter of clean energy, or at least make it so that we buy most of our energy as clean energy.

Texas, and this is surprising to most Texans, even though it's bigger, they are a net importer of energy. They don't pump enough oil in Texas to satisfy the energy demand in Texas.

And the swing when it went from revenue brought in from exporting energy to all the rest of the states to being a net consumer was dramatic. I mean, the shift, you know, gone from a basically a surplus to a deficit.

And, you know, we're deficit. Why don't we set an agenda, a clear target, that says that's where we're all going. We may not get there. I mean, you know, being a net clean energy exporter, but if we don't have the target we won't all go there.

I got out of the airplane this morning and said my goal is to get to this meeting room. And I had to do all the things that I had to do. Get a car and schlep all my stuff, and I made it here because it was important to me. I had a goal to be here. But if we don't lay the goal out clearly then not much happens.

This is the closest I get to promotion. Oh, wait, let's see, Bob. I think I've covered most of what was on that one. So go on to the next one.

This is the, it's a colored chart which shows what the Solar Energy Industry Association has done. And the idea is it captures the four benefits of solar energy. You know, energy employment, export and the environment. And don't discount exports. The markets there are huge. And we're sitting in a place where, though we have a natural abundance of sunshine, the New York State ERDA folks I don't think are going to try to capitalize on this. They're going to use the sun they have. But we have a golden opportunity here and we can manufacture clean energy.

But let me get back to what I promised to speak about is that I thought about the R&D process. And there's six things I said needed to be done. First, you have to focus on the real problem.

Should be able to get you one of these because I'm sure you won't be able to read that.

The first was focus on the real problem. And solar energy is cheap, but it's only a thousand watts per square meter. Wind energy is somewhere between 800 watts and 2,000 watts per square meter, depending on wind speed. And the machines that capture these things have to be large and inexpensive.

So our conclusion in the early days was solar was a materials problem. Not an engineering problem. You know, but a materials problem. Cost performance and life of materials needed to be generated. And you've heard that said here before.



Second is call together the national experts to make a plan.

Third is -- why don't you put the, I'll read these, Bob, but you go ahead and put the next chart up.

The next chart shows what actually happened. What I did was try to follow a market driven R&D. The piece up in the upper left-hand corner was a national solar materials plan. It was published first in 1997. So I'm speaking for long-term R&D. This isn't something that just fell off the turnip truck.

And when it started to get to the point where technologies needed to go forward, if you could read the left side of the chart, I gave you one that you can, you would see it comes out of R&D and to proof of concept, prototype validation, manufacturing, reliability verifications and system performance, or system enhancements.

And so in the second block down there where it says commercialization plant, that was developed in 1990 by the Solar Energy Industries Association. There's a similar plan for PV. There's a similar plan for biomass. There's a similar plan for wind. Plans all exist.

And they had a lot of industry interaction, these plans, and where it handed off from the top to the bottom was where it got out of science and into engineering. Because now you had the nucleation of things that were going down the development chain into real world applications.

Now, when you get to the bottom one, you'll see if you look across the top there, I use the dish sterling as an example because it's one I could get my hands on easily, but if you could read the little print on the top you'd see cost performance

and reliability written across there. And it may not be the actual reliability, it's the perceived reliability.

You walk in with a new turbine and someone says, well, I've never seen that one operate before. It's a lot different than saying we've got four of these that have run over here for eight years, and, you know, they haven't fouled up by corrosion and the ammonia's still where we put it, and this thing's just pumping out power. And then they'll beat a path to your door.

So this is a process that started in 1979, went through 1990 with good industry support, and now has got us down at 1996 where we think that we can make recommendations to the Committee as to what things would be worthwhile doing in an R&D nature. That wasn't the purpose of what we're doing here.

I should say that, you know, the national labs, universities, all those other folks helped develop the R&D part, and then industry together with the national labs and universities went on into the commercialization part. And then it became cost shared. And that's the hand off between where it becomes now an engineering problem.

We have as much unobtainium as we're going to get. And so now the question is how to engineer around it to make a real product. And that's where, you know, my company has come forward with a group of companies, including venture capitalists, and put \$18 million on the table to match DOE's 18 million to try to make a venture out of this.

And believe me those people aren't interested in putting up that money if they don't see a return. Now they may not be looking at an instant return,

but they do want to see a return. And it has to be in a reasonable period of time. Three to five years from their perspective.

One of the public benefits, number six, is to help your companies that are here stay number one in the world. You know, you've heard what's happened to some other technologies that, you know, we backed off a little bit, and the competition worldwide said, hey, there's a market out here, we're going to go for that.

And PV, we've had that happen. Now we're recapturing it.

The ETAP program is an excellent example of how to work on the bottom right inside that chart. It's been a successful program. Or at least I claim it to be successful. And it's helped many of the technologies get through those engineering challenges that are cost performance and reliability.

I couldn't resist this when I had it. It's not in your package, but it just shows that the money that was spent really did reduce the price of the system. There were a lot of casualties along the way, but we're now to the point where we can generate, you know, 25 cent a kilowatt hour electricity. So we're getting down there.

And in the beginning, no one would believe you could get there from here. And now proof of concept's been shown with the federal money. The state can really help leverage this on to capture those jobs for the state.

So for item three, your question, discuss lessons learned. One is you got to have a goal. You know, energy independence. You know, I'll let you determine what it should be.

Second is you got to have the vision of success and champions to make it happen. There are a lot of champions sitting in this room for different technologies and they've made their companies do things they otherwise wouldn't have done.

Don't slow down those champions. I mean I left the government service or national labs to go into industry because the government couldn't commercialize technology.

You know, make sure you have a plan of national scope and many of them are in place. Take those and let the staff plan the needed California focused R&D to capture those benefits, the jobs, the export market.

You know, we want to be where this stuff is the showcase. I mean I like seeing you out on the cutting edge. I don't want you to pull back from there at all because I think that's what makes California different from most other states. We tend to value the things that other people aren't valuing yet, but will.

The industry and the CEC must develop a commercialization plan to prioritize. Because there's not enough money, and cost shared money will come in from industry to move those things along which are close. And that's the business must cost share.

And if energy RSD is conducted with industry, DOE and CEC, it does work if it's planned well and managed. And I think that there are many good examples of that.

**MR. WEINBERG:** Thank you, Barry. Any questions?

**COMMISSIONER ROHY:** May I start with my usual question. You

said government can't commercialize things. You said that private, in fact, venture capitalists are going into this project, and then you also said it's an opportunity for California to put public goods money into it.

Now I'm very confused of where public goods fit if venture capitalists are already in it and they want a three to five year return and they expect that return, why should we put public goods R&D money into it?

**DR. BUTLER:** I think the venture capitalists are putting in, what I would call for them, very upfront money.

**COMMISSIONER ROHY:** By the way, I'm not testing this project. I'm testing the concept of general --

**DR. BUTLER:** No, no. They are willing, and even some of the utilities are willing to come forward because they see the long-term need. And what they want to see is they want to see reliability. They want to see kilowatt hours generated, you know, for a given system.

And so the venture money that we're getting now is the really aggressive venture capitalists putting in two million, three million, four million at a pop, but once it gets to the point where it needs hundreds of millions, they won't do that based on the, it's got to be really proven to them. So they need to see these things work. And not for a year, but for at least two or three years so there's real O&M history.

And, admittedly, this falls right in the gap. I mean, we've been talking in the other committee about merging technologies, and this sort of falls right in the gap between what's emerging technologies and what's R&D. And I urge you to

weigh that very carefully because things get, fall in this crack because they don't match one definition and they don't match the other, but I think they're still good technologies in that basket.

**COMMISSIONER ROHY:** And I certainly don't question the what's sometimes called the valley of death between R&D and product that does exist. My questions are to try to tease out this answer of where does public goods and private goods, where does the separation and where's the overlap, and where should we, the government, spend money and where does the private industry start spending more of their money?

I don't have an answer. I'm just testing all you folks to help formulate an answer.

**DR. BUTLER:** I think to help bridge the valley of death, I think it's not only important that industry cost share, but I think that there should be mechanisms for the investments that you make. Since you've got five years worth of investment and then maybe out of the business, that what you need is rolling funds.

And that there's no reason the state or the federal government shouldn't profit from the benefits of their contribution that look like equity compared to other investors' equity. And it's a very powerful tool to have a government money standing beside private investment money.

The mechanisms to do that I think are very fuzzy right now, but I think that may keep us out of the valley of death. Because there are ways, I mean, it doesn't make sense that Californians should invest in this technology for the rest of

the country out of a spirit of altruism. We ought to create the jobs here, and we ought to be able to create a revenue stream that works for you as well as us.

I may be a minority holder in that, but I, because I didn't clear that with anyone, but I do believe that that's a way to get through the valley of death.

**MR. WEINBERG:** I have one question. And that was somewhere although you need to get together and focus on the real problem.

**DR. BUTLER:** Right in the beginning.

**MR. WEINBERG:** Yeah. As I get older, I find out that finding the real problem becomes much more difficult. And do you have a feeling about should public interest R&D money be used to help define the real problem?

**DR. BUTLER:** I believe it should. I think that's where the federal program is focused very heavily on trying to make sure that a reasonable population of things are funded there. So it may be a stretch to say to the state, "Go do that." It's a question of whether you believe being done well.

**MR. WEINBERG:** Thank you.

**DR. BUTLER:** Thanks.

**MR. WEINBERG:** Let me go on with the next presenter then. Let me get on with Mark.

Mark Modera is a researcher and a principal investor with the Lawrence Berkeley National Lab and a partner in a company called Aerosol Incorporated. Aeroseal, I'm sorry. I apologize. Aeroseal is a new company formed to commercialize and market a duct sealant technology developed through research funded by CIEE and attacking what I consider probably is a real problem within the

building industry in California.

Mark.

**MR. MODERA:** Okay. I've been sitting and thinking that I can give any of three different talks right now. Because I have bullets on my view graphs, and I can talk. I could stress this one or that one or the other one, and essentially part of the problem is that, well, I think I just figured out that I might be walking into the valley of death.

But what I started out with, what I was going to, my comments were going to address, was public interest R&D. From the point of a mercenary organization, basically people who live off of research, otherwise known as the University of California, right, and who are not going to out grow that habit. I mean they're going to keep that habit, and I would pause it that they do serve some role in public interest R&D in that that's what they were put there for.

I'm going to talk about one particular area called thermal energy distribution. And I'm going to talk about it from two rather different perspectives. One is as a principal investigator. They wouldn't let me invest in the university, but they'll let me investigate it. And that's at the end of the spectrum, as I said, in sort of doing research for a living.

And the other part of it is at the other end of the spectrum, which I consider to be a commercial venture. Which I walked into this room thinking, well, that commercial venture, the slide that you'd like us to draw between public interest and non-public interest, it was really clear to me that this company is not there for public interest.



But after sitting through and listening to all these other talks, I'm not convinced anymore.

**MR. WEINBERG:** Ten minutes is up.

[Laughter]

**MR. MODERA:** Thank you.

All right, very quickly, Lawrence Berkeley Laboratory, most of you know what it is. As I said, this is what it does. It takes money from people and spends it. Hopefully it produces public goods. And I like to think it does. At least my group.

Aeroseal Incorporated, the idea of that, that hat, is to commercialize the technology that we've licensed from LB&L. And one place where I thought it did do public goods, this is my sort of stating of organizational goals, and actually I'm going to follow the questions, is to transform common practices for residential HVAC. Which is to say our idea is to basically change the way people put in heating and cooling systems into people's buildings.

Okay, just quickly, what is thermal energy distribution? It's essentially the way that you transport heating, cooling or ventilation air in and around buildings. I don't need to dwell on that.

What I would like to point out what I consider to be our accomplishments, and sort of what the public interest and what's not public interest. As I said, we do public sector research. Most of what we do is to go after a problem, sort of identify a problem and try to solve that problem. And the accomplishments are not necessarily a technology.

The accomplishments in this case, this company that was created, is based upon a technology that I believe will be successful, and I believe that it was an innovation, and we've, as I said, maybe I'm walking to the chasm of death with that, but who knows of the valley of death.

However, I would say our major accomplishment was not, was not, creating that technology. The major public good that we created was what Carl Weinberg just said. He just said here they are, they're actually going after a real problem.

Well, seven years ago I can't believe you would have said that. Because nobody believed that. I would get up, I would give talks to people, and I'd tell them that their duct systems leak, and they'd say, well, not my duct systems. Right.

After a bunch of years taking lots of data, going to people's houses, mostly in California, but we found the same thing in other parts of the country, what is the public good. The public good is the fact that people now know that this is a problem. All right. That is worth far more, right, than this technology that I invented.

I mean I hope the technology's worth more than me personally. But in terms of the public good, the public interest that we created, it's the fact that we created an awareness that allows us as, in terms of developing the technology, to have a market to sell it to.

Do I sound like I'm preaching?

Okay. What do I consider to be elements of success. I would say obviously you have to pick the right problem. One point relative to the choice of

the problem is that I -- I have to speak into the microphone? I can't walk over and point at the screen.

Okay if I talk like this. I'll wing it like this, thanks.

Anyway, in terms of you have to choose the problem. And I heard a lot of the discussion has focused on the technology. And I agree with what I heard, right, is you don't focus on necessarily the technology, you focus on, you call it the product. I would call it the problem. And so you have to pick the right problem.

Once you do that, I believe you should use some sort of a vertically integrated research program. What that means in plain English is you should try to minimize how many hand offs you have. There's something to be said for minimizing how many times people have to hand their idea and all their knowledge to the next person who's supposed to, it's like playing telephone in a classroom when you're in the third grade.

The other thing that I believe, and I don't believe that, you know, this does not mean send all your money to Lawrence Berkeley Laboratory, what leadership by a non-profit research entity means is I think you need some role by somebody who is not perceived by the world as having a financial interest in this.

If you create that role, that's a very very important distinction. What we have found is that when I go and I give a talk as an LBL scientist, people listen to me because they assume I know nothing about money. However, if I go somewhere and I give a talk where I'm talking about selling a product, a particular product, right, the audience reaction is very different.

If you want to make major changes in public perception, it's very

important to have at least some players in your teams be players who do not have a vested interest in the money.

That's what this means right here.

In terms of research portfolio, well, there's research portfolio from the point of view of you need to have different projects. But what I mean here, and what I found to be what I call my elements of success, is that in my research portfolio what I put together is I needed to have products that I would generate at very different time horizons.

We come up with one, one product. The particular product that Aeroseal's involved with, the time horizon for that was it was ten years ago that I thought of that idea, right, and only now is it coming to fruition. I had to have intermediate products all along the way to make sure that everybody felt like we were accomplishing something.

I also had to have a portfolio -- so you need a portfolio in time horizon. You need a portfolio in terms of risk level. You need to have different levels of risk. You need to have some products where the risk may be as high and some where it's not so high. Because if everything is high risk in any one given program, you stand too much of a risk of losing the whole thing.

And finally what I found, at least my experience in terms of my success with this, was that the input by industry, it was valuable having some input up front; but to be honest, the first input I got from industry is we don't have a problem, right. And then over time industries started to realize they had the problem, and then you got the industry input which is much more useful at that

stage.

Okay. What I mean by vertically integrated research, need to define what the problem is, you need to define what the savings potential is, you need to look what are the impediments to the savings. Maybe it's technology. Maybe it's not technology.

Part of the problem, at least in the case of thermal energy distribution what I found is, yes, there were technical problems. And, yes, we went after some of those technical problems. But a lot of the problems was not just technology. It was you needed rating tools. You had no way, within the market, no way to give signals to people that you had something good or something bad.

What did we do. We had to go out and develop measurement techniques. You can call that technology. But we didn't know exactly what we needed to do when, right.

So it took some time to go through this process. It also took an approach where, and this is where I wanted to make my point about the hand offs, if you have too many hand offs, it's really difficult to have someone look at the big picture.

And I guess I had the good fortune to be able to be able to look at the big picture. To structure a program whereby I could look at all aspects of the problem and not have a vested interest in my one particular technology or my one particular part of the game, right.

You know, I'm a sociologist. All I care about it's a people problem, right. I'm a technologist. It's a technology problem. To look at the entire picture.

And that's where I think many research programs fail, and where all this, all the knocks of DOE come from, which are not necessarily inappropriate.

I have to be careful.

Okay. This is my one view graph. I've got two view graphs to go, and then I'm out of here.

One view graph relative to the company is that this company would not exist without earlier public goods or public interest R&D, right. If we develop this technology without having done all of that other stuff, we might as well just close up our doors today.

The long-term success, and this is where, this is perhaps that valley of death, the long-term success of this technology may depend upon some continued public interest R&D to continue to provide technical information for the marketplace.

On the other hand, I did not imagine my company being in a position to conduct that type of public interest R&D. It's much better done at a research institution that is not perceived as having a vested interest in it.

And last view graph I'm just going to give you a quick sort of what it took in terms of funding to get Carl to say what he just said. We started off at very low funding levels. Like a hundred thousand dollars a year. And, in fact, were able to sort of prove a concept, you know prove a technology that it would work in the laboratory at these levels of funding. Very early in the process.

On the other hand, once you have a proven technology, sure enough people are willing to give you money. This is money from the US EPA, there's

money from EPRI. Once we got to that stage, you can attract more money at that point.

I think there is value in terms of public interest to invest small sums of money around this end of the spectrum and not necessarily at this end of the spectrum. Maybe it's both. I mean I'm not going to say what you should do with the money completely, but there's a full spectrum here, and this is just pointing out the research portfolio.

And the last thing, last comment on this, is what this represents. That's \$3.5 million. So that's what I spent over the past, oh, six years or whatever it is. And with that money about a million of it went towards the development of technology. The other two and a half million went towards other things, which I believe are equally important in terms of the success.

With that, I'll stop my comments and answer any questions.

**COMMISSIONER SHARPLESS:** Quick question for Mark. Mark, I've heard your presentation before. It just gets better with time.

**MR. MODERA:** Thank you.

**COMMISSIONER SHARPLESS:** You know, you've heard a lot of conversation today, and I think one of the things that is probably just sort of a common sense kind of thing is that there are a lot of different types of research projects out there. And I don't know if we can design something that one size fits all. You definitely have to be focused. There are a variety of needs out there. And problem definition, I think, is one of the things that your talk focuses on.

Just to try to tie this into other things we've heard today, did you start

off your project with an idea that you were going to commercialize something?

**MR. MODERA:** No.

**COMMISSIONER SHARPLESS:** So how did you determine success early on in your project? If this were today, and this group of people were the panel trying to decide whether or not to fund your research.

**MR. MODERA:** How would I convince you?

**COMMISSIONER SHARPLESS:** How would you convince us?

**MR. MODERA:** Okay. What I would do, well, I did it once, right. I sat down. I said, okay, how big of a problem. How much energy is involved here, right. So just look at the size of the pie, right. How much money, how much energy's involved.

What do I believe are the wastes. What are the inefficiencies associated with that, and I made them up, right, because we, you know, we had data from one or two houses. And I extrapolated from one up to a million, which is what scientists do in the first year.

Once I'd done that, I came up with a hypothesis, right. And presented my hypothesis with a lot of nice words around it, right, to explain why I was qualified that you should pay me to deal with my hypothesis.

And essentially what I did is I outlined the problem, showed how large it was, showed what the potential savings I believed could be and gave some viable possibilities of ways that we could go about solving it.

Then I said, give me the money, and I'll see if I can do a good job with it.



**COMMISSIONER ROHY:** How much was that first sum of money that you got?

**MR. MODERA:** I think I got \$150,000.

**COMMISSIONER SHARPLESS:** So it was the observation, stupid, is that it?

**MR. MODERA:** I wouldn't say that.

**COMMISSIONER SHARPLESS:** Okay. Thank you.

**COMMISSIONER ROHY:** Certainly wasn't the tap dance, I suspect.

**MR. WEINBERG:** Any other question? Okay.

**COMMISSIONER ROHY:** Very good presentation.

**MR. WEINBERG:** I think it's interesting, just as a comment from me, is that one of the things you've talked about here is identifying a need, which, in essence, eventually establishes a market. And there are aspects of public interest R&D that needs to begin to look at or support those kinds of things.

**COMMISSIONER SHARPLESS:** Exactly. Some of the themes we've heard today is that your program ought to be market driven. Well, Mark started off with something that wasn't market driven. You had to show the market that there was a need. And so there's a mix of things here that we're dealing with.

**MR. WEINBERG:** In fact he's also commented that we may have to continue to show the market there is a need.

**MR. MODERA:** To a certain extent, yes.

**MR. WEINBERG:** Again, to really get an educational process going that people understand that it is worthwhile these things. This is kind of a barrier of

understanding, an information barrier.

**MR. MODERA:** On the other hand, it was more than simply saying, it was marketive in the sense that I could see that there should be a market for it, right. It wasn't that I know the market, there it is, there's the people with the dollars lining up. It was more there is --

**COMMISSIONER SHARPLESS:** But you didn't have a whole lot of stakeholders.

**MR. MODERA:** In the beginning.

**COMMISSIONER SHARPLESS:** No.

**MR. MODERA:** No, I did not.

**COMMISSIONER SHARPLESS:** I meant if we started a process that said, you know, the stakeholders are going to sit around the table, you would have been a stakeholder.

**MR. MODERA:** Yes. What would have happened is the people who, the industry, the people who put in duct systems and build duct systems, would have said, oh, we don't have that problem, right. If you ask us, tell them to go away, right. And then it wouldn't have done any of this. So you're correct.

**MR. WEINBERG:** We can't forget that every new idea starts with a minority of one.

Okay. Next presenter is Dr. Donald Aitken who is a Senior Scientist for the Union of Concerned Scientists. And he has a Ph.D. in Nuclear Physics. Another person that moved over into solar, the real nuclear, and has served as Research Physicist at Stanford.

He started the Department of Environmental Studies at San Jose State University. He was Chairman of the American Solar Energy Society. He was, as part of DOE, he was Executive Director of DOE's Western Regional Solar Energy Center. He's also a member of the Board of the International Solar Energy Society. And he is extremely busy with the UCS all over the country. I run into him everywhere. Legislative and Policy Development.

And I would just mention here that the Union of Concerned Scientists is, I would say, an organization that produces ideas much more than specific commercial products. And if any of you have read their report, for instance, on repowering the Midwest, there's a very powerful concepts and ideas within that that deal with the public interest. Not just with a commercial product that has to be commercialized.

So, Don.

**DR. AITKEN:** Thank you. I'm honored to be with this group of business practical stakeholders.

Although I am mindful of the way to solve the problem in the barn, using the gun seems to be a bit extreme. Usually a shovel will solve most of the problems that we have to deal with, whether it's in this room or in anywhere else. And I would try the shovel and see what's left before I think I'd go to the gun metaphor.

I just returned, as you know actually, from Stockholm last night where I was one of the principal speakers at a 50th birthday celebration for the King of Sweden. He's quite an environmentalist and wanted a symposium in his honor on

this transition day. And one thing that occurred to me is if you had us address you as Your Majesty or Your Highness or something like that, it really commands a much higher level of respect. Makes us just a bit in awe. It was a lot of fun as you can imagine.

**COMMISSIONER ROHY:** Well, since the official committee is not here, you may do that to them in their absence.

[Laughter]

**DR. AITKEN:** Well, I think Chuck Imbrecht has that already worked out, doesn't he? Don't quote me. That's all right.

[Laughter]

**DR. AITKEN:** A problem with being gone those last 12 days was that I didn't receive your November 15 transmission 'til here, and so couldn't prepare transparencies for you. But I've been putting notes together, and I've grouped them under the three questions as efficiently as I can.

I'm intrigued that we had representation from Wisconsin here. I actually have come to California from Wisconsin. And partly because of that Union of Concerned Scientists is under commission by the Wisconsin Energy Center to assist in presenting the energy code workshops throughout the state. And we're under commission by the Wisconsin Public Service for technical assistance and whole building design. So we do a little bit more than just the words and reports that we do.

Just a bit about UCS for your first question. It's a public interest organization that focuses on areas related to the introduction of new technologies

into the US economy and US society.

Energy is a major technical emphasis of ours. We have a hundred thousand sponsors, of whom 15,000 are bona fide Ph.D. and what we call our Scientists Action Network. Thirteen thousand of those sponsors live in California. And so I've been officially representing them as their intervenor in this whole process here and at CPUC. It's a constituency of people who bring a lot of talent to bear in perspective on these topical areas.

We have a small budget compared to NRDC and EDF and the others of about \$4 million a year. Fifty percent of that comes in from the hundred thousand sponsors. It's voluntary contributions, averages maybe \$20 per person. And it's the use of that \$2 million that can allow us to be out and representing the public interest in hearings and doing the kind of stuff you folks see me doing a lot of the time.

The other 50 percent of our budget is from foundations from state governments, from the United States Department of Energy and occasionally from utilities.

And what we do is provide RD&D support as well as policy support. We'll do analyses that will help trigger RD&D or will help or trigger the climate that will bring funds into RD&D that needs to be done in the public interest.

We leverage the funds that we get. For example, from DOE, with our own private funds in order to enlarge the scope of what we're able to do as a public interest organization.

Our work and energy is resource and economic analyses to help promote hardware applications, hardware development and systems integration of

new technologies in utility scale applications.

And I'm talking about my particular niche in UCS arms control is as big an area as energy in ours.

Our research is to enhance the efficiency of RD&D efforts in producing practical results. Producing results with social benefit. And to the extent that we can bring scientific expertise in and assist, as we do through our group of scientists, and enhance what's being learned and also to critically appraise what's being learned, we do that.

Our work in energy is to actively develop the basis for enhanced market activities and commercialization of renewables. It was in papers that we published in 1991, '92, that we popularize the idea of, the term of "sustained orderly development." And that's been adopted as a driver, program driver by SMUD, for example.

Moving just briefly to your question number two, and my writing gets smaller and smaller here, I'll just pick this up. And for those of you who know I hate to use notes. You've never seen me use notes before. My apologies there.

UCS resource and economic policies analyses cross institutional boundaries. That's something we're able to do.

Carl just mentioned the power in the Midwest analysis where we took on 13 states of the Midwest. We took the existing resource analysis that had been done, but we, for the first time, applied geographic information systems, GIS information system processing of it, and found we could take available wind and solar data and make it much more locally relevant. You could really tell.

In fact, if Buffalo Ridge had not been discovered out in the field in southwestern Minnesota, our re-analysis of the data are just using computer techniques would have discovered Buffalo Ridge. And which is now a part of a very important wind resource in the United States.

But then we also took that analysis and we laid on the utility transmission network and we laid on utility economics so that we produced a document which presents Midwestern renewable energy resources in the language of utility economics. So it really focuses very efficiently where the work should be done, where they should look for the resources, where additional work needs to be done. So it tends to focus the work of others.

Our renewable energy economics also includes the values that go outside of the kind of work that utilities can do. The values of tax revenues. The values of industrial development. The values of job creation and support. To state revenues.

So we combine utility economics with state centered economics. We use the tools of input/output analysis in order to do this. But the result is to be able to affect utility company policy and regulatory policies and state legislatively mandated policies simultaneously as a package to show the way the package is integrate to produce the greatest economic good for the state or for the work that's done.

So it leaves a couple of vital elements, which were asked in your question number two. The vital element number one is that public interest RD&D not be defined too narrowly. Its purpose has to promote cross boundary work. Just

the kind of work that wouldn't be done in the self interest of a company trying to promote a product.

Your questions have really been directed at that. And when you direct what is the boundary here, well, it's when you get rid of the boundaries. And we cross the boundaries, so that we see that this work being developed, being done to develop this product, is going to have these environmental benefits and these job creation benefits and these benefits for the state economy from greater efficiency in the investment of energy dollars in California.

It's that kind of work that I think is critical to reveal in publicly supported RD&D. In other words, to be willing and able to reveal the cross institutional cross boundary values of the work that is being funded.

Utilities have told me, for example, and this isn't to fault them at all, that they're not in the job creation business. Because I'm constantly talking job creation value.

So utility RD&D programs won't include economic valuations showing job creation benefits. And state economic evaluations generally can't really show utility economics.

And when you put the two of them together, you quite often find you get economic valuations that greatly exceed the individual valuations of either the utility to support the R&D or the state to use public funds to support the work as well. When you put these things together it can quite often reveal that.

Organizations such as UCS and Natural Resources Council, Environmental Defense Fund and the CEC, and I lump the CEC in with this, in that



are appropriate vehicles for what I call transboundary analyses. It's rather unusual that I would lump a state institution into something providing that really broad range of public benefits. I think California's unique with their CEC, and the CEC Staff members know that I'm a consistent supporter of the capability of what you can do here.

Vital element number two I wrote here is to target public goods RD&D toward the stakeholders who will benefit from that RD&D in order to have those stakeholders become the vehicle then for carrying the commercialization momentum.

So to the extent that public monies are being used to support RD&D, we need to have an idea of what the ultimate stakeholder communities may be from that. And how we might enlist those stakeholders then in crossing this as people have both used and misused the concept of valley of death here.

There's this bridge between the R&D and the market support, and you've got that gap in the middle you have to cross. And if you can have a stakeholder community saying this RD&D is coming down, it's getting interesting now, we are ready to try to pull that into our line of work.

We had done that with the utilities under restructuring. That's increasingly difficult and we'll cry more and more of the kind of institutions that we're talking about today.

And finally to your question number three how to structure and run a program that may address our own interests as an organization. That's to define the benefits sought as a package of public goods elements. There's a package of public

interest elements. To seek through RD&D to identify, to reveal and to quantify benefits that feed from one institution to another.

For example, from the utilities to the state treasury, or that feed from one stakeholder group to another group of stakeholders. For example, that feed from the RD&D to environmental quality, and consequently to environmental regulators that feed from RD&D to public health implications, or that feed from RD&D and utility applications to overall state well being. Economic well being.

I'll just close with an example from Wisconsin that we did not author. They are numbers that came out last year where the State of Wisconsin compared two scenarios for 750 megawatts of new electric generation capacity. One was conventional generation capacity, and the second one was all renewables. And they used renewables that were the most economic in the State of Wisconsin. Most of the largest share was biomass based, but they had some solar, some wind and so on.

And they came out with a renewables package which was about half a cent per kilowatt hour more than the conventional. And so the Public Service Commission of Wisconsin would have made the, what appeared to be, the responsible choice of the lower cost resource package because it would have lower impact on the ratepayers.

And then the state included that benefit, that analysis to encompass the job creations that would come out and the revenues from job creation and these other things, and they came out that if the more expensive renewable package were selected, the State of Wisconsin would realize \$1.6 billion more in direct disposable income than in the conventional package. They would realize \$3.1 billion more in

gross domestic product than they would from the conventional package.

And when you convert that back, which I did in a subsequent paper, back to effective kilowatt hours, you find that there's an additional one and a half to two and a half cents per kilowatt hour in hidden benefits to the state if you choose the package that costs one-half cent a kilowatt more.

And the alternative is to say that if one chooses the lower package, the lower cost package, the state treasury is kicking in from one cent to two cent of kilowatt hour, per kilowatt hour, in lost directly tangible economic benefits by making the conventional choice.

Now it's not fair to ask a utility to make that kind of analysis, and it can be very difficult for the state to make that kind of analysis. But when you do, you can get results that can be incredibly important in targeting where you put your emphasis toward which technologies, which commercialization and so on.

So that's all I have at this moment.

**MR. WEINBERG:** Let me ask you, Don, we're right on time, we're getting a little bit behind on time, but one of the things again that was brought out by you and also by Mark, I think it was this concept of sort of a not-for-profit independent kind of view? And I would guess I'm not sure everybody would agree that UCS is necessarily an independent, but I guess it's independent outside of a commercial venture different.

Is it important to have that kind of view? I mean this seems to be what you were pitching, that there was another group that can look at things to try to find the real problem and the real economics.

**DR. AITKEN:** Well, absolutely. And I think as you're defining the new entity that's going to be responsible for the public interests, public goods RD&D in this state, that the analysis that affects the priorities that are set by that entity has to be exactly this kind of analysis, a disinterested total public benefits analysis. And I believe the CEC can do much of that, and I believe that we and other organizations can contribute as well.

I think it's very difficult otherwise to ask any of the particular stakeholder communities to do it. In the first place, our Midwest report was \$200,000 worth of computer time. That was a serious work.

So I would concur with what you're saying. That there has to be a mechanism by which you can provide this total system cost boundary analyses that then feeds back into setting the priorities by the institution itself. And that's got to be expressed in language that people can understand, you know, English. Clear, very clear.

**MR. WEINBERG:** Everybody has their own language.

**DR. AITKEN:** Well, I'm a little bothered by the, I'm always bothered when DOE is beaten up because I worked for DOE for awhile. And it's a very complex organization with incredibly dedicated people who are trying to do a good job. And some of the problem of beating up DOE is really is people not quite understanding the basis on which they're, either they're doing research or the research is accidentally put on the shelf through no fault of DOE.

**MR. WEINBERG:** But I guess I'm also interested in any quick comments you might have on the question then of defining stakeholders. Because

to some extent this morning we talked a lot about sort of companies, technology representatives, but you would broaden that definition of stakeholder to --

**DR. AITKEN:** Absolutely.

**MR. WEINBERG:** -- involve more kinds of public interest groups I guess?

**DR. AITKEN:** No, the citizens of California. The people who are paying tax dollars and trying to get a, you know, maximum economic return for what they do, or paying their electric utility bills and trying to get the maximum return that will come in in other ways to their way of life and to their economic support.

So it's clearly going to be a little bit of the utility bills that everybody pays, after all, in support of this. And that needs to come back in ways that contribute to making other economic investments in other aspects of their lives more efficient as they live in California.

**COMMISSIONER SHARPLESS:** Don, could I ask a question along that line since it's brought up. In some of what we've heard today is getting the biggest bang for the small number of bucks that we have here and to really focus the program down to some areas where there are basic holes in the system where the state could really benefit.

How does that kind of focusing of the program relate to the type of valuation that you're suggesting we go through in order to establish research priorities?

**DR. AITKEN:** I think it fits right in.

I'm going to just give an example when you're talking about the PV and you asked Dan Shugar are we not talking more about a product than of technology. And then actually we heard the response later on that if you're doing photovoltaics that's just solid state physics, that's what it is. And the moment photovoltaics moves from solid state physics to anything at all of direct value to society, you're dealing with products.

And that can be evaluated, that moving from the physics into the product and the potential impact of the product, I think in terms of the larger valuation, the larger potential valuation, and improving environmental quality and increasing efficiency of capital and so on, one needs to make projections of potential scenario of applications.

It doesn't take much money. I think where SAIC is right now, it isn't going to take much money in order to have a real burst on the scene which gives a cut of major multiple return with investments.

**COMMISSIONER SHARPLESS:** So in some cases under your scenario there might be projects that are longer term that require more financing but receive much larger benefits from the type of evaluation you're suggesting versus something that has a shorter term, quicker turn around, quicker commercialization that maybe doesn't have the same broad base benefits. In that case you would say go for the bigger one and leave the smaller one behind.

**DR. AITKEN:** Well, I'd be careful because we've heard today recommendations, and I agree with them, they've got to be both both short term and long term simultaneously. Short term gets real stuff out in the field. You've heard

me use the --

**COMMISSIONER SHARPLESS:** So what you're doing is despite your over arching evaluation then you need to balance within the context of that over evaluation, over arching evaluation, some stuff that can come on line quicker but not to lose sight of the value of those longer term that have the larger, the longer term. Do you have anything in mind as to how that split might work?

**DR. AITKEN:** I think risk valuation is very helpful in determining that split. We've talked about trying to isolate somewhat from the economic problems we're going to have if there is suddenly a gas price shock or an oil price shock. Both of which, for the people who read the Atlantic monthly article that came out recently, could well happen within five years.

And short-term things begin to help meet a shorter term risk. The longer term heading toward diversity and isolating from major international issues and so on. It can help prioritize them.

I tend to like to use risk analysis in a way of such that we balance short term and long term always trying to reduce the risks of the unknowns coming in and upsetting the California economy in ways over which we have no control.

The more short-term things we do, the more immediate control we have of some of our energy sector. The more long-term things we do, the more chance we have of positioning ourselves from the really larger issues that are going to hit us in energy in the next 10, 20 years.

**COMMISSIONER SHARPLESS:** But, well, that risk isn't really another evaluation. It's part of the overall benefit evaluation; isn't it?

**DR. AITKEN:** That's correct. But it helps assign priorities to short term and long term and suggests you have a package of both.

I'm not saying this is an only one. This happens to be a favorite of mine is really attaching risk valuation as much as possible to prioritizing things.

**COMMISSIONER SHARPLESS:** And you say that's currently one of the mechanisms that the Union for Concerned Scientists have. They have the methodology worked out, and you apply it.

**DR. AITKEN:** Don't I wish. We're working with Telus Institute [phonetic] and some others to try to do that. And we're getting there. It's not all neat and tidy yet. We might need some more research funds to do it.

[Laughter]

**COMMISSIONER SHARPLESS:** Thank you.

**DR. AITKEN:** Well, if we're selling their products. Thanks very much.

**MR. WEINBERG:** Well, that sort of concludes the panel. We are running slightly behind time right now. I don't know if there's any general questions you might have of the panel. I think we're probably going to have to speed up and finish up here, right?

We got a whole bunch of questions we can ask about. But again I want to thank the panel very much for their presentation. It certainly was helpful in trying to formulate where this program may go.

So let me turn it over to Mike DeAngelis and let me give all the panelists a round of applause.



[Applause]

**MR. DeANGELIS:** Given the late time of the hearing now today, I think that what we should do is move on to really the third phase of the hearing, which is to open it up for public comment for all of you stakeholders out there who have your own comments about the lessons learned of your work with R&D institutions.

And I was going to provide some opening comments regarding this, but I got a cold, I'm having trouble speaking, and it's kind of late, so I'm really going to speed up my comments.

Mike Batham is passing around a handout, and in addition to your own lessons learned, what's clear that what we want to hear from you on has to do with the RD&D plan itself that California would develop. A multi-year California public interest RD&D plan, what you think should be included in it, what you think should not be included into it, any comments you might have about the process we intend to go through in the future, number of months to produce this California public interest RD&D plan.

And, secondly, we'd like your comments also related to the administrative and expenditure criteria which is in AB 1890 that the CEC is to operate its program based upon that from the Legislature.

We heard at the mid-October en banc hearing from some stakeholders they felt that they wanted input to the administrative and expenditure criteria so we adjusted our process a bit and said, okay, we will discuss that in workshops, and eventually some time in January or so we will provide input from stakeholders to

the Legislature on the administrative and expenditure criteria.

To cover again what Mike Batham handed out to you is really a starting point for both developing a plan and also for the administrative and expenditure criteria. You'll see on the second page of the handout that there's a series of questions that really need to be answered for planning, developing a California public interest RD&D plan. Some of these questions we'll need to address on the planning process.

I would actually group these questions in a number of different categories. First of all I'd put them in a category of addressing the plan direction and emphasis of the plan. Also the scope of the RD&D plan. Several of these questions really fit what should be the scope of coverage in the public interest RD&D plan.

Third, there are a whole series of questions on how the RD&D program for public interest is conducted, which may need to be addressed in the planning process. And, finally, there are a couple of questions towards the end about program evaluation and tech transfer.

So I think what we should do now is just open it up. I know that many of you have filled out a blue card. Those of you who have not filled out a blue card but have some comments, fill out a blue card and give it to Cathy who is in the red coat in the back of the room over there.

And I think, Commissioner Rohy, you have a number of cards you may want to call on, stakeholders.

**COMMISSIONER ROHY:** There are quite a few cards here. I'm not sure how many of the people are here at this point in the day, but I'd like to limit

the comments to five or six minutes per card. I figure if everyone's here that's about an hour. So that would leave time for little else today. So if I can have that type of cooperation, we'll start with Chuck Solt. Is he here?

**MR. WEINBERG:** Let me say the panelists are welcome to stay, but there's no requirement that you continue to sit where you are.

**COMMISSIONER ROHY:** David Duchane. Am I pronouncing it correctly?

**MR. DUCHANE:** David Duchane.

**COMMISSIONER ROHY:** Duchane. As you address the microphone there, please give your name and association so the recorder will have that.

**MR. DUCHANE:** Yes, my name is David Duchane, and I'm with the Los Alamos National Laboratory. I'm here because I'm involved in a technology known as Hot Dry Rock Geothermal Energy.

You may be familiar with this. It's a technology which entails drilling down into the earth, obtaining energy from dry hot rock rather than the conventional geothermal resources.

This is a technology that in my opinion has been demonstrated to work but has not proven its commercial viability yet. It has to cross that gap that we've talked about today of being something that appears to have value, but we still don't know for sure what that value is.

I would contend that this is the sort of project that the California Energy Commission ought to be supporting. The sort of technology, that technology that can pay big dividends but does not yet have those investors standing in line to

develop it.

I do have a lot of evidence that I will submit at the proper time that shows that we indeed are at that state, but I would just ask that the Commission consider these kinds of projects and really move California to the forefront of energy technology development by taking these technologies and turning them into practical sources of all the parts of those four E's. The exports, the energy, the environment and the jobs that these new technologies can provide.

Thank you.

**COMMISSIONER ROHY:** May I ask a question on this. Is we talked about stakeholder groups. Is this a technology that has a large stakeholder group at this time?

**MR. DUCHANE:** If one considers the stakeholder group to be the private organizations that intend to make a profit from this technology, the stakeholder group at this time is there but it's limited. If one considers the stakeholders to be the citizens of the State of California, the vast HDR resource indeed makes every citizen of this state a stakeholder.

**COMMISSIONER ROHY:** Thank you.

**MR. DUCHANE:** Thank you.

**COMMISSIONER ROHY:** Let's see, I believe our next speaker is Orville Moe. Is Orville in the audience?

**MR. MOE:** My name is Orville Moe. I'm President of Energy 2000, and we're a fuel cell company.

And in a sense, after listening to all of this today, maybe just those two

words are enough to summarize the situation. That fuel cells are a developing technology and are, in many cases, out there. We have over a hundred systems out in the field, and we just recently I just got a phone call today from my partners that are back at the office saying that it looks like we got the engineering contract to put in a biogas fed fuel cell at one of the local waste disposal plants.

They were moved to do that by the Malibu fire which took out their electric power. And water treatment plants are in a pretty bad problem when the power goes out and they're sitting there still receiving a lot of effluent from the pipe. As you can imagine.

So in any event I think those kinds of things are public good. That's a real project that we have received some help from DOE in terms of funding support for that project.

**COMMISSIONER ROHY:** Excuse me. Just to be clear, is the public good here is using different fuels in a fuel cell that you're --

**MR. MOE:** Both. In the criteria, as I was looking up in the library here today, alternate fuels are defined, in fact I took a copy of it, biomass and waste products and etcetera. So we fit that category.

At the same time we're providing a low cost solution to a municipality to waste treatment problem where they're going to cut some between 30 and \$60,000 a month off of their utility bill by using the gas that they generate. Plus giving them the added advantage of having a standby system, if you will, that's going to be there whether the power lines get knocked down or not by the next Malibu fire that comes along. There's been three of them since I've lived in that area.

And at the other side of the coin is a new research and development project that we've just started, which is in cooperation with a solar plant out of Phoenix, solar company, solar energy company. And in that one we're using a fuel cell, if you will, running in reverse where it is producing hydrogen as a fuel, as an energy storage media.

And those pieces of hardware, those technologies have been proven thanks to cooperation with Jet Propulsion Labs, NASA, Department of Energy and some of the colleges.

So we kind of touch a lot of the basis that were mentioned today, and I just, I'll make this very brief, but, you know, we hope to be in the running for those kinds of fundings and support that just kind of push this over the edge. We would not have gotten that Los Vergenes Waste Treatment Plant without the approximately a dollar a kilowatt, dollar a watt cost boost that we were able to take off of that program to make it pencil out for them.

And it's very key, I think, in many areas for federal and state funds to step in and just provide that extra little measure. Even though we're at \$3 a watt in terms of an off, you know, push it off the delivery dock price. Getting it down that extra dollar really made a lot of difference in whether they could see their way clear to go in and finance this thing for a long period of time and reap the benefits that they will. And it does pencil out. They will end up making a profit.

So our stakeholder spectrum includes, I think, some of the municipalities we've contacted. There's over 600 waste treatment plants out there in California that could benefit from this technology. There's a broad spectrum of

other users. Hospitals and private companies and the like that can make use of fuel cells.

But it's a broad area, and we look forward to seeing support and help from the state in pushing this technology forward.

**COMMISSIONER ROHY:** Thank you very much.

Carl Blumstein. You thought you'd never get up on this list, right? But you were near the top. You're number three or four.

**MR. BLUMSTEIN:** Thank you, Commissioner Rohy. I'm Carl Blumstein from the University of California.

As Jim Cole mentioned, the University's involved in the administration of a number of public interest R&D programs. And I think we can offer ourselves as something of a resource in the planning for administration and expenditure criteria.

I'm not going to try to do that today given the lateness of the hour, but only to say that we think that that little provision in Subdivision F of Section 381 of Public Utilities Code actually may provide an opportunity to look at some very new and interesting ways to address R&D administration. And we want to work with you. We see that that's a main part of the agenda on December 17, and we will be there.

I wanted, also, just to mention a couple of points on the comments of this morning and this afternoon. One might have had the impression listening to the presentations this morning that R&D planning was a sort of orderly sequential process. I think it's a bit more like making legislation. It's sort of if you like R&D

plans or if you like sausages, you shouldn't see either one of them being made. They are messy and there's a lot of iteration and non-linearity and going back and iterating.

I think that the Commission should be prepared in its development to go through some of that, and that certainly in my experience with RD&D planning that's what it's like. It's not orderly, and there's lots of trade offs, and you make them for all kinds of reasons.

Finally on the discussion today which had a lot of emphasis on commercialization, it seemed to me that the University has been rather consistently urging cooperation among state agencies. I think we should also think about cooperation among the programs provided by AB 1890.

And I'm particularly referring to the emerging technologies part of the renewables funding and the market transformation part of the energy efficiency funding. I believe that those may provide substantial resources for commercialization.

You think in looking at what the working group report had to say, I think it could be reasonably interpreted to say that the commercialization in the RD&D funds should focus primarily on technologies that were being supported by the RD&D program. That it should not be prospecting for technologies emerging from around the country or around the world but should be focused on that sort of vertical integration that Mark Modera was talking about.

I think that's about all. Thanks.

**COMMISSIONER ROHY:** Well, thank you, Carl. And I look forward



to working with the University of California and the other universities in the State of California. I think they have a significant role to play in this RD&D, and perhaps was under emphasized today in our discussions.

**MR. BLUMSTEIN:** Thank you, Commissioner.

**COMMISSIONER ROHY:** Michael Theroux.

**MR. THEROUX:** Good afternoon, Commissioners. I represent a local agency, the Sierra Economic Development District, which is a federally tagged group dealing with four of our local communities, four of our local counties.

SEDD is focused upon local rural economics in particular and we are in a position to handle the administration of strategic planning for our counties. Also programmatic project overview.

We come to the Energy Commission particularly because of the specific effects of the deregulation on the local economics and on the resource impacts that have occurred because of that. We find in the last two years of assessment some of the questions that you've posed we find some answers to.

In particular, we find that it is the linkage between the various pieces, the components of our economic pattern in our communities, that move the renewable resource from its place to the end markets that we need to support. That's what makes it renewable. And that by taking a look at the economic flow completely through the system we find that there are weak links.

In particular for the biomass management that has been our focus, the extraction of all of that woody material from the forests themselves depended to a large degree upon the structure of the biomass energy plants in the area. When that

collapsed in '94 we found many things occur besides the plants themselves going down. A lot of people lost a lot.

And we have been trying to focus first on the existing communities and the existing businesses to see what we might do to augment the individuals, the individual businesses and pick them back up and get them moving again.

And once that group of components has been identified to provide a much broader advertising, if you will, of the products that we can value add through that system, and kind of push some of that funding back up to the front again. Add the value as you go toward the end market, move the capital back up toward the front.

The break in the system was near the front. We couldn't get the biomass out of the forests. Everything depended upon one end market. Can't do that.

Our position at this time is to continue a very pointed parallel effort. A market assessment, identifying further the individual components of resource managers, extraction processing, intermediary market management and end markets of which energy is a very clear continuing interest.

And secondly, to run demonstration projects in a number of those different areas. The demonstration projects point to a specific need I think you might do well to keep in mind, and that, we feel, is that when you address a renewable resource that the emphasis be placed upon the entire flow that allows that resource to remain renewable.

And in the case of the biomass in particular in the rural communities

of the Sierra Nevada Mountains, we have a need that has been compounded by the effect of deregulation. There have been serious environmental impacts, resource impacts, natural resource impacts and economic impacts.

And by filling in some of the gaps, by assessing exactly what those links are, by knowing where in the system things fell apart. Whether it's the fact that the small businessman processing chips simply can't keep his equipment up and running in this area anymore, or the gluts that occur within a particular marketplace.

If we know where those places are and we can put faces and dollars to those specific individuals that are in a region, then we can find a template. And it is that economic template that we have been in the process of developing.

We believe that we have a template that can be applied to other regions. We also feel that because of the prominence of the Tahoe Basin that we can find that a public awareness can be pursued here by showing that we can plug in people back into a process.

If by addressing the concerns from the resource extraction to the final end markets we can move that flow, that value add going down and the cash going back up to the front. If we find that we can boost that process, then we have accomplished a mechanism that takes some of the weight off of a portion of energy production.

In the past, energy production was holding the entire market. We can't allow that to occur. When that broke a little bit not only did the energy production suffer, but the entire economic process faltered in our region. And the ability to

remove the very critical element of, in this case, trash, biomass in the forest, now threatens our forest by that overload of fuel loading. And the question of what to do with it still remains.

Again, I think I would look toward that solution here, and that is that in the entire pattern from the resource to its end market, if you can diversify the growth across that entire spectrum, you'll support all of the pieces in that growth, including in particular the production of energy as one of those end markets.

**COMMISSIONER ROHY:** Thank you very much.

Bud Beebe. Is he still here? Oh, there you are.

**MR. WHITNEY:** As you can tell, I'm not Bud from SMUD.

**COMMISSIONER ROHY:** I was looking for Bud there.

**MR. WHITNEY:** Well, he left and left me his notes. So if you'll bare with me I'll try to deliver this.

As you very well may know, SMUD has had an advanced and renewable technologies program for a number of years, and we've had a fair degree of success with that program. And we have certainly operated our program with the idea that it was for the public good. And some of the things that we have learned out of that I think are certainly germane to the process that is before us here.

We have worked very hard, as was noted in this morning's panel, to put in place goals and criteria, the planning process that led us to be able to put in place a program that accomplished public good for our customers.

The challenge that we see now though is that with restructuring from 1890 is quite a different set of rules are in front of us and we are very concerned

about the ability to continue to provide the benefits for the public that we have through our advanced and renewables technologies in the past.

We think that in order to be successful with these kind of programs in the new order the stakeholders are definitely going to have to be involved, not just in the process before us today, but also as we proceed into the future and operate whatever finally comes out of this process and make sure that there's appropriate feedback and mid-course adjustments made in the program.

One thing that hasn't been mentioned but is really important is the timing of all of this. Our experience has been that I the collaborative forum, and that's really what we're talking about creating here in many respects. There's collaborative RD&D. There is an enormous amount of time taken to put these programs in place.

Typically, to put in place a program with the Department of Energy it takes a minimum of 18 months. And if you missed the annual budgeting cycle it can add easily another year to that process.

We are only talking about a four-year period here. So there is some concern about whether or not there is time to do very much that is truly meaningful. And with that in mind, we may want to look at what is the follow-on program going to be like after the four years is up.

We were involved in the development of the CPUC RD&D Working Group Report. We feel that that really does investigate many of the issues before us in quite some depth, and makes many good recommendations.

I'm pleased to see with a handout that was given to us today, which I

think we'll be filing testimony on, really refers back to many of the issues that were developed in that report. And I would recommend it to all involved to really study that.

As we go forward, there's a number of things with the various goals and criteria that need to be established really on a statewide basis. In the past, SMUD has established those for itself for its own purposes. But as we go into the restructuring it would really be fine if we had statewide goals and criteria that we could use then to develop our own programs and then to define the R&D programs that we could be involved with as we collaborate with the state and other stakeholders.

Those criteria need to be visionary and open to the extent that they can be modified as we learn things about the different technologies and as the different signals come back to us from the marketplace.

We are going to find in that process that there may in fact be some technologies and options that we have elected to support that finally turn up as to not be viable in the circumstance that we're going to find before us. We need to be able to knowingly and timely make the cuts to get back so that those technologies are not squandering the very limited resources that we have available.

So we look forward to being involved in this process and commend you for holding this workshop today. Thank you.

**COMMISSIONER ROHY:** Thank you for your comments. And I know what Bud would look like without a beard.

[Laughter]

**COMMISSIONER ROHY:** John Benemann.

**MR. BENEMANN:** Let me identify. I am John Benemann. I'm an independent full-time consultant. I work for the Department of Energy which has been mentioned a few times here today, EPRI, TVA and some utilities. I have been in numerous R&D review and planning committees. And my major current activity which is tonight is to help prepare CO2 mitigation program for DOE for coal and fossil fuel power plants.

What I would like to contribute to this hearing is to make the case before public interest RD&D in the global climate change area, which I think is indeed a public interest activity.

As we all know, the environment is a common, and I think that therefore it in large measure a government function, because there is no private gain investing in commons. We cannot expect utilities to invest in research that is not actually contributing to reducing the costs, and indeed global change is an increaser.

And I think that the reduction in RD&D by utilities is already well advanced as you all know. We can only look at the EPRI funding and what happened there.

In July of this year the Clinton Administration announced new policy in climate change. The US in the future will seek targets for greenhouse gas reductions that are enforceable, verifiable, global, economically efficient, and effective in reducing the threat of global warming.

What these policies are in terms of numbers is everybody's guess

because it is going to be subject to negotiation. But I gather to say that this new Clinton-Gore policy on climate change will have a great, a potential importance to the electric utility industry in the long and even the mid-term.

I wanted to make the case that RD&D on the renewables and energy efficiency technologies will help meet this global climate challenge. It will have many local and regional benefits which have been talked about today.

I only have to mention that my area of interest which is biomass, converting the rice straw to either power or biofuels is certainly a local benefit aside from the global one.

I will shorten my remarks because of the lateness of the day. I would like to say that we cannot expect too much activity from either international or even the federal government levels in this area, despite all of the nice words that are being said about this.

I can point out that less than \$1 million per year is being spent currently by the federal government on reducing CO<sub>2</sub> emissions by power plants, which is hardly even a drop in the bucket.

This compares to several hundred millions of dollars being spent on technologies on Japan alone. And basically what they tell us, tell me, we like you to spend \$1.6 billion on studying the problem. We will spend a few hundred million dollars on solving it. If there's a problem, we will sell you our solutions. I think we can make a case for we should be doing this as public interest research in the United States.

We cannot expect any help either from the purveyors of the fossil



fuels. I just read an article by the Chairman of the Exxon Corporation who attacked the ominous economic implications of the new Clinton-Gore policy saying that it will lead to worldwide fuel rationing.

And he also went on to point out that 96 percent of the carbon dioxide in the atmosphere is contributed by nature and is beyond our control. This is not only misleading and wrong, although also contradictory, but I don't want to go into why that is wrong and why that is misleading.

**COMMISSIONER ROHY:** Thank you. That's not the object of today's hearing. We are on R&D planning issues.

**MR. BENEMANN:** But I think that the point there that we should -- we can make a case for the State of California to take a leading role in protecting not only our local and state environment, but also the global environment. And I think the electricity production was one -- gas emissions is certainly a major player in this area.

So I want to leave it at that and thank you for the attention.

**COMMISSIONER ROHY:** Thank you for your comments. We will take them under consideration as we go forward.

Jane Turnbull.

**MS. TURNBULL:** I would like to take advantage of the overhead.

**COMMISSIONER ROHY:** You may, but please use the microphone while you are there.

And again, I'd like to ask to speakers to stay in the five to six minute range.

**MR. TURNBULL:** Okay. I'll try to go as quickly as possible.

I am Jane H. Turnbull. I am now in business for myself, but I do have a little bit of personal history. I am also part of Carl's R&D tutorage way back when. Spent five years at R&D in San Ramon, mostly in the renewables area.

One of the major projects I did toward the end of my period with PG&E was to take a look at the 46 biomass plants tied to the PG&E grid to look at their operational characteristics, their performance and what the long term future held for them. And I could see at the time that the future was a little bit ominous.

Based on that work, I went to EPRI and worked at EPRI for five years looking at biomass as a national resource. As Hank Courtright pointed out this morning, EPRI does things in terms of key products. And during my five years there I did three key products at EPRI, all the biomass area.

One was on strategies for sustainable biomass systems, a business plan approach for implementation of sustainable biomass systems, commercialization of small modular biomass systems, and I also was instrumental in the establishment of the national biofuels roundtable.

Since August, I have been in business for myself in the hope that I can make some of these biomass systems realities.

What I'd like to mention today is that I did serve on a biomass collaborative that was convened by the CEC. Mike Smith called it about a year ago. The emphasis was to look largely at what state government could do to foster implementation of a long term renewables program and perhaps save some of the existing biomass plants that were out there that were really being threatened.

My emphasis was not on saving something that was out there, but perhaps shifting the focus toward might be commercial in the long term.

At that time, we did feel that there was need for a number of advisory committees. A renewables -- and so I am proposing as a renewables R&D advisory committee that would come up with a comprehensive portfolio program.

At the same time, a state renewables committee that would bring together the agency people. There were nine agencies represented on this biomass collaborative, and their focus was to look at ways in which the state agencies could actually foster the implementation of renewables, break down some of the barriers that were acting as constraints.

I think the CEC staff has an ongoing role in terms of coming up with priorities and objectives and making them known to the public, and providing an annual report to the Legislature.

I'd like to start here with what biomass systems cost at this point in time. If we're to go out and put in a new biomass system, the capital for new commercial IGCC, this is biomass gasification combined cycle plants, is going to be between two and four cents a kilowatt hour. The O&M costs are going to be between two and two-and-a-half cents a kilowatt hour. The fuel costs are probably at this time about \$34 a bone dry ton, which comes to about two cents a kilowatt hour.

In no way does this compete with natural gas. And what needs to be done is to focus on each individual component of those costs in a systems approach and attempt to improve the competitiveness looking at each of those components.

My suggestion is to come up with a research agenda that is an R&D

agenda but it also will tie to the existing renewables budget coming from the other portion of the emerging technologies, to assess possible retrofits of existing facilities, conversion of a hybrid biomass natural gas combined cycle unit.

EPRI has just gone this week, in fact we are signing later this week, a patent application on a hybrid system that looks as though it will be very promising. It will be a gas turbine system and the condensing steam turbine will be the biomass portion.

Inclusion of an innovative fuel drying option. Fuel drying will make a lot of these systems with 22 percent efficiency perhaps approach 25 or 26 efficiencies.

Also, look to see if there is an opportunity for cogeneration out there.

Collaboration with some of the Scandinavian companies that already have brought down their O&M costs considerably.

Reductions in fuel costs. There is a number of European harvesting systems that are being effectively used in Scandinavia that could be adapted in this country. Bruce Hartzog, who is the harvesting expert at the University of California at Davis, is acquainted with these and would be very interested in trying to demonstrate them in this country.

Also, collaboration with DOE's program, especially the one at Oakridge in terms of dedicated biomass crops.

And my last point is opportunities associated with emerging technologies for rural economic development and export markets. We have great opportunities here if we act in a creative kind of way.

We could establish discrete enterprise zones throughout the state to

encourage integrated system commercialization. Michael Theroux' comments earlier spoke to what he was trying to do, and in several counties that makes really very good sense. I've been working up in Siskiyou County on a very similar kind of effort looking at what might be done both from an economic development point of view and from an energy development point of view.

Small modular biomass systems would be appropriately used in forests and they would also be used for disaster remediation, when there is forest -- wooden debris after natural disasters, no place to put that except in the local landfill. A mobil modular unit could be used there.

There also in an enormous market for these systems that could be developed here in this state and then marketed in the developing countries.

In addition, there is work going on at the University of California at Davis on anaerobic digestion systems. This is the best work that's being done in the country right now. There is no funding available to foster the commercialization of it. I suggest that that be fostered.

Thank you very much.

**COMMISSIONER ROHY:** Thank you for your comments.

Bob Mucica. Please use the microphone to the left there.

**MR. MUCICA:** My name is Bob Mucica. I'm with Rockwell International. We are located in Canoga Park, California.

My position with Rockwell is similar to Barry Butler's SAIC is the responsible director for an advanced business area in commercial solar products and in advanced power systems both for land and space applications.

My purpose here today as a stakeholder to speak to the issue of RD&D for solar commercial power towers. Bechtel and Rockwell are teamed together for solar power towers. We've been basically investing in this technology through Solar II since about 1992-93 timeframe.

Unlike some of the other R&D that has been conducted, we have invested in the RD&D at Solar II with a commercialization vision. Not to see just what would come out of it. We had our mind pretty well made up at that particular time what we were going to be going after.

Currently, we are pursuing a dual pathway in the area of solar power towers. The first is for an emerging commercial plant. The Solar II project represents the demonstration that was required for us to participate now in a commercialization activity. As such, through AB 1890, we are petitioning funds as an emerging solar commercialization plan. However, like many activities, we see the absolute need for continuing RD&D in that particular technology.

Under the emerging commercial plant we did the technology development under Solar II. It's located near Barstow. And just a quick picture, it is a little bit better seen in the handout. That is a picture of Solar II. It has been up and operating now since about the May timeframe.

We anticipate being able to give our first commercial fixed price bid for a solar facility in 1997.

Like most commercial adventures, however, we cannot just stop with the status quo. Our business is such that we do need to continue product improvements and new R&D.

So what we are asking for is to provide continued support of the Solar II facility. And we would like to utilize that as an advanced technology demonstration facility.

The value of the Solar II facility is probably close to \$200 million in capital costs. It continues to use a sizeable portfolio of dollars, if you would, to continue operation of that facility.

Our next endeavor in the commercialization arena is hopefully going to have an advanced hybrid that will also provide an attractive market entry position for us, especially in some of the new and developing countries like India and in Egypt. They are very interested in hybrid plants.

One of the key components to making that a viable plant is to develop a salt/air heat exchanger which would offer us a significant increase in efficiency of the overall plant. Maybe 10 to 14 percent increase in efficiency. And I've got a little schematic that I'll just elaborate a little further on.

The top portion is basically a standard combined cycle power plant with natural gas input. The bottom portion is basically now a similar facility to Solar II. We have the hot storage capability which has been demonstrated, the center receiver which has been demonstrated, and the various pumps and valves and so forth, and the collector field.

What we want to do now is to tie this in and provide a nitrate salt to compressed air heat exchanger here. This device has never been manufactured. It has never been RD&D'd before. It is a very key ingredient as the hot gas input to the combustor.

This down here would represent the bottoming cycle, and this is the traditional role currently with the salt to water steam evaporator system similar in principle to that used at Solar II. So that component, plus the essential elements of the design associated with this system would greatly assist the next step forward into commercialization of hybrid plants and we believe to be a very good candidate for the RD&D sources to be provided by the state.

Thank you.

**COMMISSIONER ROHY:** Thank you for your comments today.

George Hay. I thought I saw you still hiding back there. You are only going to have one view graph, George?

**MR. HAY:** Only one. Only one.

[Laughter]

**MR. HAY:** My reputation precedes me.

**COMMISSIONER ROHY:** Is he part of your fraternity?

**MR. WEINBERG:** Yes, he's also an alumni of --

**MR. HAY:** You can tell by the way he insults.

My name is George Hay. I'm the president of CAGT LLC which is also a small California based firm in Lafayette, California. CAGT LLC recently took over management of the CAGT program from the Electric Power Research Institute who is still a sponsor.

But we wanted to make some comments on CAGT as a model for collaborative RD&D for public good and an experiment and progress. We are living the restructuring changes.



CAGT began as a collaborative effort originally by the California investor owned utilities -- it stands for the Collaborative Advanced Gas Turbine Program -- and the California Energy Commission. And it grew out of the energy efficiency hearings by the Energy Commission in 1991 on what future technologies might replace the 20,000 megawatts of existing and aging fossil units, many of which are not up for sale.

We were also attempting to achieve the California goals for efficiency and reduced cost of future options. We would also like to thank the Energy Commission for being a sponsor in our research phase of the program.

CAGT was set up, if you look at this diagram and there were two earlier versions of this presented, one by Betsy of PG&E who presented one version. Dan Shugar presented another.

This is actually the original version from *Research Magazine*. It was a very great article on R&D prioritization approaches. But as you go through the knowledge building or the R&D stage into the strategic positioning or demo, and then ultimately in the California situation it is what is going to replace those 20,000 megawatts. It's big business, and do you want to do it with unproven technology? And how do you get those technologies to the starting gate?

To CAGT went through a process of putting together all of the different California utilities and stakeholders to analyze all sorts of different advance cycles. And in that \$5 million process in 1991 through '94 we identified a superior technology to go to the next step, the demonstration phase.

It was a very interesting process of working with manufacturers and

users and looking at future markets as well as looking at technologies. And we are now at that gap, as I've heard it referred to -- or getting over the wall, or bridging the gap stage -- of we need to go to a demonstration phase or it is never going to happen.

The program CAGT is expanding to include some scope and distributed gen and advanced cycles that are all really R&D type programs. But the big issue, the technology that we really think would benefit California the most really drive down future costs, improve the system, improve energy efficiency, do lots of good things. It's not going to happen without a demo, we discovered.

Gas turbine prices have dropped in the last few years significantly. The DOE program, as good as it is, doesn't cover all the needs of the country. And we are now at a stage of looking for a demo project and we fundamentally are finding that all of California investor owned utilities are dropping out of CAGT because they are not in the generation business any longer. It's not in their interest.

We feel the goals of CAGT remain in the public interest. And we would like -- we are really looking to the CEC and AB 1890 for confirmation that the original CEC goals of high efficiency, low cost and environmental quality remain those of the public interest.

The CAGT is significantly moved through the R&D phase with public good funding from the IOUs. Without public good funding for the demonstration phase of the RD&D, the advanced technologies that we're looking at won't happen. This is probably true of a lot of other advanced technologies. But when the market moves quickly and it's time to replace a lot of the steam units in California, the penalty to California will essentially be an option that isn't at the starting gate when

it needs to be.

Those are my comments. Thank you.

**COMMISSIONER ROHY:** Thank you, George.

I'm going to have trouble with this next name, so please bear with me.

Is it Necy Sumait? I apologize.

**MS. SUMAIT:** Okay, Commissioner Rohy. I'm Necy Sumait with Arkenol, Inc. We are a small privately held company based in Mission Viejo, California. Arkenol is a technology development company with patented economic improvements to the well known process of acid hydrolysis for conversion of cellulose into mixed sugar streams.

Combined with our fermentation expertise, we are focused on building a business that makes use of locally available biomass for the production of by-based chemicals including ethanol, a renewable clean burning fuel.

The Arkenol technology can utilize a variety of feed stock ranging from agricultural residues such as rice straw, wheat straw, etcetera, to municipal solid waste. The commercial plants are designed for minimum effluent discharge and maximum acid recycle.

The flexibility in the feedstock, coupled with the environmentally benign technology, allow Arkenol to embark on projects which would result in significant environmental and socio-economic benefits while providing solutions to regional problems.

An application of our technology is a project right here in Sacramento County to convert rice straw into ethanol. By diverting the rice straw from open

field burning, the project results in significant regional air quality benefits while providing the Sacramento Valley growers with a viable disposal option for the rice straw in the phase of increasing prohibitions against open field burning.

Technologies such as the Arkenol process which utilize the energy from the sun trapped in the plant materials to produce renewable energy breathe new life into the economy.

The RD&D working group in its September 6, 1996 report to the California Public Utilities Commission appropriately identified clean burning fuel as one of the topics for public interest RD&D activities.

Clean burning fuel, such as ethanol produced through the Arkenol process, provides significant benefits to California citizens. These benefits include the continued viability of the agricultural industry, management of regional waste disposal problems, improvement in regional air quality, and increase in energy security.

In addition, having received the benefit of review under the California Environmental Quality Act by the CEC, the ethanol plant designed for our Sacramento includes appropriate conditions to ensure the protection of public health and safety and that no significant environmental impacts result from project development activities.

Programs such as those to be developed under AB 1890 are important in advancing technologies which are environmentally benign and has the potential to achieve sustainable commercial success.

The RD&D program must be broad and flexible in scope where funding

is allocated on a project-by-project basis depending on the merits of the particular project. And as with other CEC program development activities, the plan development should be conducted in an open and public process allowing for collaboration between the diverse groups of interested parties, namely the academia, government, industry and the public at large.

The administrative and funding criteria established must be flexible, but equitable. It must be efficient and socially responsible and should encourage projects that are renewable, environmentally benign, and provide broad public benefits. We are looking forward to working with the Committee and staff on developing this program and in participating in as many workshops as our schedule permits.

I also invite the Commission and those that are interested to visit our Web page at [arkenol.com](http://arkenol.com) to obtain more information about our technology and our projects.

Thank you.

**COMMISSIONER ROHY:** Thank you for your comments today.

James Sahagian? I messed that one up, I can tell. I can't even blame it late on the day. It is just my poor command of the language, I think.

**MR. SAHAGIAN:** I'll keep my comments brief given the lateness of the hour.

I'm here today representing Photovoltaics International. We're known as PVI Corporation. Formerly we were SEA Corp. We are a California based manufacturer of PV systems that are used for commercial and large residential

applications.

We have an innovative linear access concentrating PV system which has a low manufacturing production rate -- excuse me, which at low manufacturing production rates will, we feel is going to be providing very low cost PV for broad based deployment here in California.

Our company is probably a working model of a public/private partnership. We received seed funding from US DOE through National Labs and through the CEC to get the product developed and get our manufacturing base in place. These funds were matched up against private funds from the shareholdership of the company, and they've provided the foundation for the growth of our manufacturing capability.

This type of initiative, private/public partnership to bring new technologies to the forefront in California I think is very important and the public component in it is really a key piece of attracting private money in to help subsidize partially, subsidize the high cost of new company and new product introduction.

A very thoughtful and comprehensive proposal has been submitted, developed and submitted, to the renewables program committee which would accelerate the deployment of PV domestically for grid connected domestic commercial applications here in California.

And this program is one that has really two pieces. The first piece is one of seeding the deployment of PV through a graduated incentive program, this concept of sustained orderly development to bring the price of PV down through layoff that would be provided in the way of public component. And this combined

with the low interest financing we feel will be a very important basis on which to launch photovoltaic in the state, producing a really robust and sustainable marketplace.

But there's another aspect in the deployment spectrum of photovoltaics that I think falls into the arena of RD&D. And that is that although the technology is being deployed commercially today internationally and commercially, there is still a lot of opportunities in the way of the product improvement and efficiency improvements which would be prime candidates for RD&D co-funding.

Specifically, two examples might be the continued development of high-efficiency PV cells which are really the high cost component in the technology. And there are a number of very good development areas that I feel RD&D funding could be earmarked for.

The other piece -- and these are just two of many -- the other piece that would potentially deserve some RD&D focus is the development of in panel inverters that would allow the deployment of what we would call plug-and-play PV systems that could be literally put on roof tops and integrated right into the AC system of the house.

**COMMISSIONER ROHY:** Excuse me. Doesn't IBM or one of those own the plug-and-play name?

[Laughter]

**MR. SAHAGIAN:** We'll have to find a different name for it.

These are just two examples, and the list could go on. And we're just

here to encourage the Commission to keep the options open and earmark some portion of the RD&D funds for encouraging the continued development improvement of high efficiency, low cost PV systems.

**COMMISSIONER ROHY:** Thank you for your comments.

**MR. SAHAGIAN:** Thank you.

**COMMISSIONER ROHY:** Vish Palekar.

**MR. PALEKAR:** I'm here on behalf of Noxtech, Inc., a recent management buyout from Cummins Engine Company.

We would like to encourage the Commission as part of this R&D program to look at emission reduction issues. I'm sure you will, but that's been our focus of the company over the last eight years, and we would like to offer some very interesting technology and ideas that have not really been tested from a proof of concept. They are much before, if you will, proof of concept state.

We would like to see an effort in after treatment technologies as well as remote sensing in terms of monitoring and local diagnostic probes.

I'm here just to offer our assistance in any way that we can in looking at these technologies and also providing some market data, if you will, looking at low cost emission reduction issues.

Thank you.

**COMMISSIONER ROHY:** Thank you for that offer.

The last card I have is from Dr. Larry Berg. I think we only had one drop-out in the whole group of cards. That's excellent.

**DR. BERG:** My name is Larry Berg. I'm here in two capacities. One is



as a member of the international board of directors of Ballard Power Systems, a fuel cell firm located right outside of Vancouver, British Columbia. And secondly, with our US facility and our US company which is located in San Diego County. We began a new facility there earlier this year to do work on heavy duty.

I won't talk about Ballard. It's very late.

I do want to thank you for organizing this today, and I found it most interesting. But particularly one of our competitors from Energy 2000 I have to be one of those people who was evacuated in that fire area that he's going to build -- put a fuel cell in on biomass. So I'm very very interested in learning that. I don't think he's here yet and I didn't have a chance to thank him.

But I have a couple of comments I'd like to make. One which you commented on earlier today, this morning, that are things that we would like to see considered in the process rather than talk about a particular project, which I will do at a later time.

One, we have concerns about how the intellectual property and the patent rights and that whole area will be handled in some of the types of projects. For example, I agree with Mr. Sahagian that we will have our first 250 kilowatt pem [phonetic] stationary fuel cell out early next year with several others scheduled to come. But there are a number of parts to that system that need R&D work.

We just recently received a \$30 million infusion of cash from the Canadian government from the Prime Minister last week to deal with part of that. That's part of the funds that we think will be necessary to finish the commercialization of this by the end of this decade.

But with that system, we also have concerns about how to deal with the contracting process for R&D funds for the demonstration side. And I was most appreciative of your comments earlier today about that particular point.

The second observation that I'd like to make on the process is based on an earlier life I had of about 11 years on the governing board of the South Coast Air Quality Management District. And one of the individuals who helped establish the technology advancement office of that agency, I'm pleased that at least one of our speakers earlier today was one of the recipients of money from that.

But I watched that over a period now of I think eight years, and I would urge the Committee to consider the basically dividing the money into types of projects that will meet specific goals.

I think one of the things at South Coast that we did -- and I don't want to detract from the track record, but I think we put out too much money into too many small projects that didn't produce the maximum benefit over a period of time. And I would urge the Committee that in looking at some of the projects that are within two to five years of being commercially available that perhaps some of that money would go into larger type programs either at the development or the demonstration side.

And then, keep funds for the very promising but not commercially in the near fund. I think a number of people have made that comment today, and we would strongly agree with that.

And I know that in the cases there where we had the larger projects with multiple funding agencies and the private sector are the ones that tended to

move to commercialization more rapidly than some of the others which they have been -- I left there three years ago, but they have been funding at smaller amounts over a longer period of time.

Well, I had several other suggestions, but the night is late, so I think I will put those in a written material to you and to your colleagues.

And once again, thank you for this process that you had today. I really enjoyed the panels that you set up. Thank you very much.

**COMMISSIONER ROHY:** Thank you for your comments.

Are there other people here who wish to speak that have not submitted cards?

I'd like to have a few closing remarks from the Committee. But before I do, I want to especially thank Carl Weinberg who helped us set this up today, and thank you very much for your presence here today and for all the speakers and people who participated today, because this was thoroughly educating process to me.

The comments I'm about to read are from the R&D Committee, Commissioner Rakow and Commissioner -- good ol' Chuck -- Imbrecht, excuse me. I had a mental lapse there, perhaps the end of the day.

Public interest energy RD&D involves a number of concerned interests. The Commission is interested in using an open and collaborative-based process to help plan out the program. This hearing represents only the first step in that process.

During initial parts of the process, the focus will be on developing policy guidelines relating to the overall structure of the program. Later on, the

emphasis will shift toward more specific topics to be addressed by working groups.

We encourage as many interest groups as possible to be active and involved in the planning process and the working groups. However, even if you are not able to be active in the process, you can receive all documents produced by the process from either the Energy Commission's Home Page or by mail.

For those of you who can participate as stakeholders, we encourage you where possible to reach consensus on the major elements of the plan, and to provide options where consensus is not possible. And we had that discussion this morning, I believe.

From now through March 1997, we expect to hold seven stakeholder workshops. In addition, we learned from the October 16th en banc hearing that the collaborative process can only go so far in producing recommendations and reaching decisions. Therefore, we anticipate holding additional committee hearings as needed between now and March to provide specific direction to the stakeholders, particular where consensus cannot be reached.

Likewise, members of the Commission may attend the stakeholder workshops and participate in specific discussions.

Anticipated products from those activities include a plan for implementing the program, an overall program structure, and major plan elements. Major plan elements include such items as the goals and objectives of the program, types of solicitations to be conducted under the program, program categories, general eligibility criteria, administrative guidelines, project selection criteria, funding options, coordination opportunities, and program evaluation.

We anticipated releasing a draft public interest RD&D program plan by mid-April. Adoption by the full Commission is expected to occur in June 1997. This will allow us to implement the program during the last half of 1997 so it is fully operational in the first quarter of 1998 when the funds are to be available.

A side comment from my point of view, this is a very tight schedule.

In accordance with the schedule, the next three meetings will be stakeholder workshops. The first will be on December 17, 1996, beginning at 10:00 a.m. in Hearing Room A of the Commission, this room. The second on January 7, 1997, in the Bay Area, and on January 21st, possibly in Southern California.

The focus of these workshops will be program goals, scope of the plan, program issues and further discussions of administration and expenditure criteria recommendations.

Following these workshops, the Commission will hold a second hearing on January 29, 1997, in this room. Prior to that hearing we expect to have final recommendations on administrative and expenditure criteria.

That is the comment from the RD&D Committee.

I again thank all of you for attending. I'll go no further because of the lateness of the day, and wish all of you a safe trip home.

This hearing is adjourned.

[Whereupon the hearing was adjourned at 5:30 p.m.]

## **CERTIFICATE OF REPORTER**

I, **A. FLYNN**, a duly commissioned Reporter of **CourtScribes**, do hereby declare and certify under penalty of perjury that I have recorded the foregoing proceedings, constituting pages 28 through 246 only, which were held and taken at the **CALIFORNIA ENERGY COMMISSION** in Sacramento, California on the **2nd day of December 1996**.

I also declare and certify under penalty of perjury that I have caused the aforementioned proceedings to be transcribed, and that the foregoing pages constitute a true and accurate transcription of the aforementioned proceedings.

I further certify that I am not of counsel or attorney for any of the parties to said hearing, nor in any way interested in the outcome of said hearing.

Dated this **5th day of December 1996** at Foresthill, California.

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**A. FLYNN**

**REPORTER**